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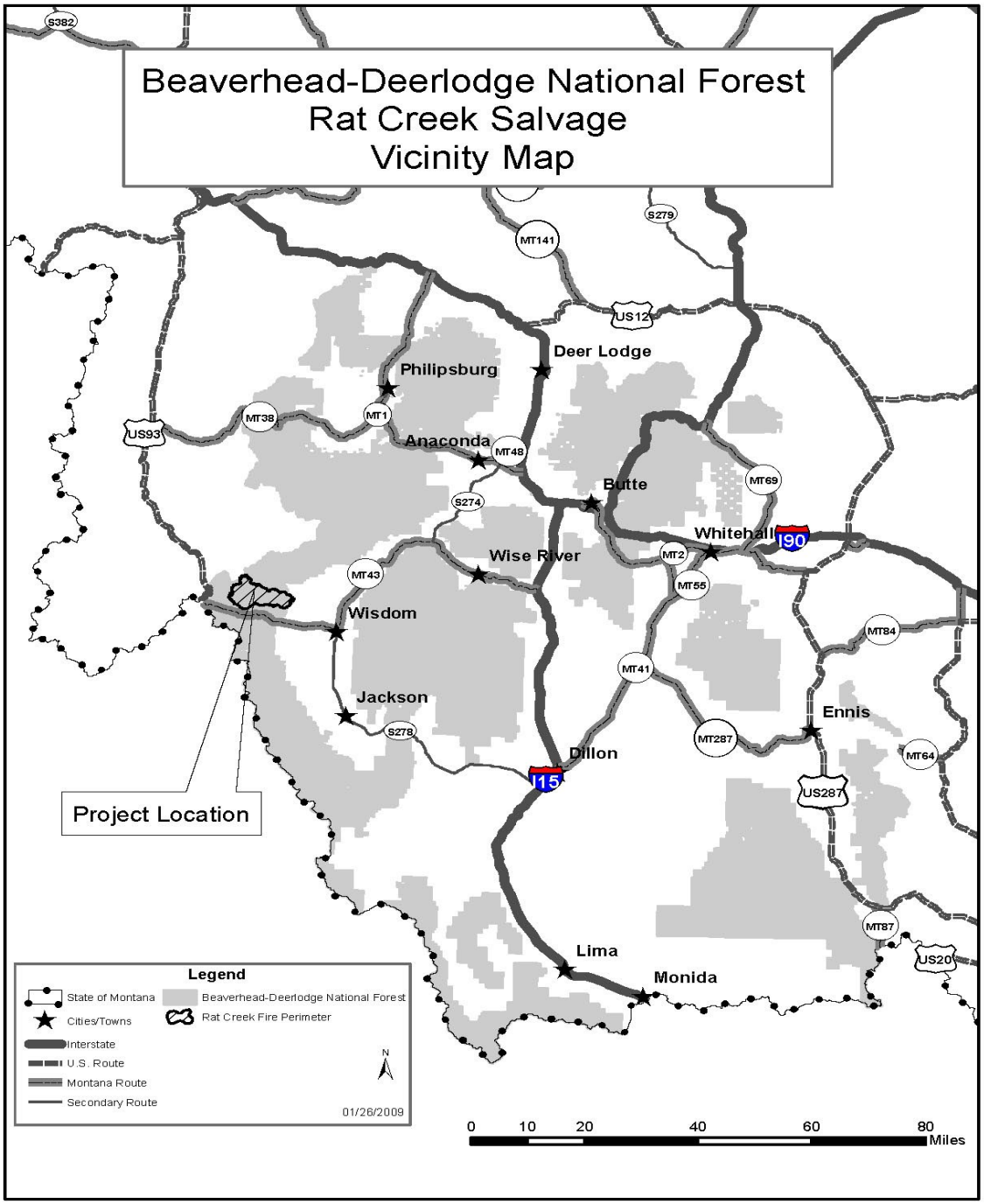
Environmental Assessment

Rat Creek Salvage

Beaverhead-Deerlodge National Forest
Beaverhead County, Montana

For Information contact: John Natvig
USDA Forest Service, TEAMS Enterprise
Hot Springs, SD 57747
605-745-3253
jnatvig@fs.fed.us



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Summary

A project on the Beaverhead-Deerlodge National Forest, Wisdom Ranger District, has been proposed to salvage harvest dead and dying trees that are a result of the 2007 Rat Creek wildfire or forest insects and disease. The project is located approximately 15 miles west of Wisdom, Montana.

The purpose of the Rat Creek Salvage Project is to recover and utilize timber from trees that are dead or dying. The trees would supply wood to the forest products industry. The proposed action is responsive to goals, objectives and standards in the Beaverhead-Deerlodge Revised Forest Plan (Forest Plan) (USDA Forest Service 2009a). The Forest Plan guides all natural resource management activities and sets management standards on the Beaverhead-Deerlodge National Forest.

Salvage harvest would occur on 35 units ranging in size from 3 to 320 acres. These units total approximately 1,652 acres across the 26,600-acre wildfire, or approximately 6 percent. This project area burned with varying intensity leaving a mosaic of dead and live trees. Trees that are likely to survive, are not infected with dwarf mistletoe and are not infested with mountain pine beetles would remain. Salvage harvest would be accomplished through conventional, ground based timber harvest activities using equipment such as rubber tired skidders, and would be limited to slopes of less than 35 percent unless site specific analysis by a soil scientist has determined damage is unlikely. The proposed harvest units would result in 11 forest openings greater than 40 acres on lands suitable for timber production activities.

Most of the road system needed to provide access for harvest operations is in place; however, approximately 7 miles of temporary roads would be built, and then obliterated at the end of the project. Approximately 3 miles of existing road currently closed to vehicle traffic would be opened and reconditioned for log hauling and timber harvest operations, and then closed again when no longer needed for this project.

This Environmental Assessment presents the results of the analysis of the direct, indirect and cumulative environmental consequences of the proposed action and no action alternatives.

Based upon the effects of the alternatives, the responsible official will decide whether to proceed with the proposed action alternative, the no action alternative, or possibly modify the proposed action.

Introduction

Document Structure

The Forest Service has prepared this Environmental Assessment in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This Environmental Assessment discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. The document is organized into four parts:

- Purpose and Need: This section includes information on the history of the project, the purpose and need for the project, and the proposal for achieving that purpose and need. This section also details how the Forest Service informed the public of the proposal and how the public responded.
- Comparison of Alternatives, including the Proposed Action: This section provides a more detailed description of the agency's proposed action. This discussion also includes project design features to reduce impacts or insure project compliance with the Beaverhead-Deerlodge Revised Forest Plan (Forest Plan) or laws and regulations. Finally, this section provides a summary table that compares the environmental consequences associated with the proposed action and no action alternatives.
- Environmental Consequences: This section describes the environmental effects of implementing the proposed action and no action alternatives. The effects of the no action alternative provide a baseline for evaluation and comparison of the revised proposed action.
- Agencies and Persons Consulted: This section provides a list of preparers and agencies consulted during the development of the Rat Creek Salvage Environmental Assessment.
- Appendices: The appendices provide more detailed information to support the analyses presented in the environmental assessment.

Additional documentation, including more detailed analyses of project-area resources, may be found in the project record located at the Forest Supervisor's Office in Dillon, Montana.

Background

A fire ignited by lightning burned approximately 26,600 acres west of Wisdom, Montana in 2007. The majority of the fire burned on the Beaverhead-Deerlodge National Forest. The Beaverhead-Deerlodge Revised Forest Plan classified approximately half of the burned area as lands suitable for timber production. These areas were being managed for long term timber production prior to the fire; there has been timber harvest and there is a network of roads from past harvest. A portion of the fire burned on the Beaver Lake Inventoried Roadless Area, Number 1-003 (USDA Forest Service 2009b, page C17). Many of the burned stands were mature lodgepole pine with smaller amounts of spruce and Douglas-fir. The fire burned at varying intensities, killing all trees in some areas, while live trees remain in other areas.

The fire directly killed trees due to crown scorch, and heating of the tree stem, cambium, and root tissue. Trees are also subsequently dying due to secondary fire effects; the indirect or delayed consequences of fire-caused heat injury or the subsequent mortality caused by insects, diseases,

or drought. Fire-caused injuries predispose trees to attack by insects or disease and many of the attacks result in tree mortality.

After a tree dies it begins to deteriorate and lose economic value. Wood deteriorates in two ways: physical deterioration and grade deterioration. Wood borers and other insects, pouch fungus and similar decay fungi are common agents causing physical wood deterioration (Lowell et al. 1992). The most common type of weather-related physical deterioration is checking, which typically causes a split or crack in the outside (sap) portion of the tree, or in a manufactured board. Grade deterioration is caused by fungi that stain the wood. While stain in itself does not result in physical deterioration of wood fiber, it does reduce the value of the final product.

Burn intensity refers to the effects of fire on vegetation. A Burned Area Emergency Rehabilitation (BAER) Report was completed in September, 2007 (USDA Forest Service 2007), after most fire suppression activities were completed, that summarized and mapped the fire affected area by the four classes of burn intensity. Table 1 identifies the burn intensity associated with each class. Table 2 summarizes the National Forest System land and private land area in each class.

Table 1: Burn Intensity Classes

Class	Vegetation Effects
1	Mostly unburned forest land; up to 20% of the area was under-burned.
2	Under-burned forest land. The understory and ground cover vegetation is scorched to unburned. Apparent direct tree mortality due to crown scorch is less than 10 percent.
3	Moderate burn intensity on forested land: 50 percent of the tree canopy is scorched; 20% of the tree canopy experienced high burn intensity; and 20 percent of the canopy is unburned; most of the understory has been consumed by fire and is interspersed in a patchwork pattern.
4	High intensity burn on forested land: more than 80 percent of the timber stand has been consumed or scorched. Significant needle cast will occur across approximately 15 percent of the high intensity forest land. All understory vegetation was consumed to ash; occasional burned duff layers remain.

Table 2: Rat Creek Fire Burn Intensity Area (acres)*

Land Ownership	Class 1: mostly unburned	Class 2: underburned	Class 3: moderate intensity burn	Class 4: high intensity burn	Total
Beaverhead-Deerlodge National Forest	4,570	4,080	7,057	9,230	24,937
Bitterroot National Forest	66	13	0	1	80
Private	7	124	209	71	411
Total	**4,643**	**2,217**	**7,266**	**9,302**	**25,428**

*Burn intensity area is based on the September 11, 2007 fire perimeter (USDA Forest Service 2007), additional areas was consumed in Fall, 2007.

Purpose and Need for Action

The purpose of the Rat Creek Salvage Project is to recover and utilize timber from trees that are dead or dying as a result of the Rat Creek Fire or forest insects and disease. The trees would supply wood to the forest products industry.

Reforestation of the harvest units through existing, on site tree seed is proposed; however most regeneration is expected to be lodgepole pine. Maintaining the pre-fire species mix of trees is desired, and planting Douglas-fir would achieve the desired mix of species.

Many of the units have overstory lodgepole pine trees that are infected with dwarf mistletoe. Dwarf mistletoe can cause declines in tree growth, reduced seed and cone production, and premature tree death (Hawksworth and Johnson 1989). Trees infested with dwarf mistletoe that survived the fire and remain alive and standing would transmit the disease to the new stand of lodgepole pine. Removal or felling of live, mistletoe infected lodgepole pine overstory trees is needed to prevent infection of the new stand of trees.

The proposed action responds to the goals and objectives outlined in the Beaverhead-Deerlodge National Forest Revised Land and Resource Management Plan (Forest Plan) (USDA Forest Service 2009a). The Rat Creek Salvage Project is within the Tie-Johnson Management Area and management objectives include timber production. The salvage project would contribute to the Forest Plan goal for the management of lands suitable for timber production (USDA Forest Service 2009a). Salvage followed by reforestation and dwarf mistletoe sanitation would also contribute to Forest Plan objectives to bring 10 percent of lands suitable for timber production into managed condition, and to maintain long term sustained yield (ibid). The cut over areas are expected to be fully stocked with trees within 5 years of salvage harvest.

Proposed Action

The Wisdom Ranger District proposes to salvage harvest dead and dying trees within the Rat Creek fire perimeter before the wood deteriorates and loses value for commercial products. Salvage harvest would occur on 35 units ranging in size from 3 to 320 acres. These units comprise the Rat Creek Salvage project area and total approximately 1,652 acres (about 6 percent) across the 26,600-acre wildfire. This project area burned with varying intensity, leaving a mosaic of dead and live trees. Trees that are likely to survive and are not infected with dwarf mistletoe or infested with mountain pine beetle would remain. Salvage harvest would be accomplished using conventional, ground based timber harvest equipment such as rubber tired skidders, and would be limited to slopes of less than 35 percent unless site specific analysis by a soil scientist has determined damage is unlikely. Most of the road system needed to provide access for harvest operations is in place; however, approximately 7 miles of temporary roads would be constructed and then obliterated at the end of the project. Approximately 3 miles of existing road currently closed to vehicle travel would be opened and reconditioned for log hauling and timber harvest operations, and then closed again to motorized vehicle use when no longer needed for the project.

The proposed harvest units would result in 11 forest openings greater than 40 acres on lands suitable for timber production activities

Proposed harvest units are expected to be reforested within 5 years of harvest through natural lodgepole pine regeneration. Planting Douglas-fir is proposed to maintain the pre-fire species mix of trees.

Dwarf mistletoe infected lodgepole pine trees that survived the fire would be cut and removed or cut and left on site to reduce dwarf mistletoe infection of the lodgepole pine regeneration.

Decision Framework

The Forest Supervisor of the Beaverhead-Deerlodge National Forest is the Responsible Official for this project's decision in accordance with direction in the Environmental Policy and Procedures FSM 1950.41. The decision to be made is whether to implement the proposed action or to take no action at this time.

Forest Plan Direction

This project is guided by management direction found in the Beaverhead-Deerlodge National Forest Revised Forest Plan (Forest Plan) (USDA Forest Service 2009a). The proposed action would contribute to Forest Plan goals to manage lands suitable for timber production for the growth and yield of sawtimber, pulpwood, and other forest products, including salvage harvest (USDA Forest Service 2009a, p. 40). The proposed action would also contribute to Forest Plan objectives to bring 10 percent of lands suitable for timber production into a managed condition (USDA Forest Service 2009a, p. 41).

The project area is within the Forest Plan Tie-Johnson Management Area. This area is managed for timber production, livestock grazing, and dispersed recreation (USDA Forest Service 2009a, page 83).

The maximum size of openings created by one regeneration harvest operation shall not exceed 40 acres, with exceptions where natural events such as fire, insect, or disease create an undesirable opening. The proposed harvest units would result in 11 forest openings greater than 40 acres on lands suitable for timber production activities. Forest Plan Timber Management Standard 2 allows regeneration harvest larger than 40 acres after public notice and review, and approval by the officer one above the responsible official (USDA Forest Service 2009a, page 41).

Public Involvement

The Wisdom District Ranger, Beaverhead-Deerlodge National Forest issued a news release on April 10, 2008 requesting public comments on the project and also issued a letter on April 9th, 2008 requesting comments to those who have shown interest in this project or similar projects. Comments were received from 8 individuals, agencies, organizations or businesses.

This proposal was listed in the Beaverhead-Deerlodge National Forest Schedule of Proposed Actions on October 1, 2008. The Wisdom District Ranger hosted a tour of the Rat Creek Fire area on Tuesday, October 21, 2008. Thirteen individuals from organizations and the public attended the tour.

Public scoping is integral to the environmental analysis process. Comments in response to scoping are used to determine the range of actions, alternatives and impacts to be considered in an analysis. Issues are points of discussion, dispute, or debate about the environmental effects of the proposed actions.

Issues

The interdisciplinary team and Forest Supervisor identified nine significant issues, which are discussed in this section, using the comments from individuals, other agencies, and interested organizations. Two issues were considered but eliminated from detailed analysis; these are discussed on EA page 10.

Reduce the existing road net work: Most roads within the project area would not be needed for a long period of time, with the exception of major roads, when the salvage harvest is completed. Motorized use and road related impacts could be reduced through the obliteration of much of the road network after salvage harvest.

Issue disposition: An alternative that decommissions Forest roads will be considered. Road closure and rehabilitation may be planned for roads associated with the proposed action, consistent with the project purpose and need, or to mitigate project effects.

Address travel management (decommission Forest System Roads): The only effective way to close roads on the project area is full obliteration of the road prism. This should be done on all roads with seasonal closures because the Forest has a poor record of compliance with motorized closures and violations of closures are common.

Issue disposition: An alternative to the proposed action that decommissions all roads with seasonal closures will be considered.

Temporary road obliteration: Temporary roads constructed to access salvage harvest should be designed and constructed in a manner that allows the roads to be obliterated after harvest is complete.

Issue disposition: The project includes design features to accomplish obliteration of temporary roads. In addition, most proposed temporary roads would be located on gentle slopes, minimizing the need for cut and fill construction.

Elk habitat effectiveness: Elk habitat effectiveness has been compromised by the Rat Creek wildfire and the existing road network. The project should include the restoration of elk habitat effectiveness.

Issue disposition: The proposed activities will comply with Forest Plan direction, including goals for elk security, and the environmental assessment will disclose the effects of the proposed activities on elk security. If analysis indicates Forest Plan direction would not be met, additional design criteria or mitigation measures may be added to the proposed action or an alternative to the proposed action.

Stream sedimentation: Proposed actions could increase the sediment levels of area streams. Wildfire disturbance combined with the impacts of salvage harvest and road construction could cause unacceptable levels of stream sedimentation. Salvage harvest activities that could cause soil disturbance should take place in the winter when the ground is frozen to minimize soil disturbance. Harvest activities should incorporate erosion control measures and roads should be designed with proper drainage.

Issue disposition: The project will include project design features to minimize soil disturbance and erosion. Potential sediment related impacts due to the proposed action and any alternatives will be disclosed in this environmental assessment.

Additional area should be salvage harvested: There is an inadequate supply of timber to area sawmills from Federal Lands. Additional timber within the Rat Creek wildfire could be salvaged.

Issue disposition: An alternative to the proposed action that treats additional area with salvage harvest will be considered.

Merchantability of the salvage timber: Potential timber purchasers have concerns regarding the merchantability of the salvage timber. The charred trees now have heavy checking (cracks into the center of the wood) making them unmerchantable for lumber, and charred trees are not merchantable as pulp wood. The removal of non-sawlog material should be optional due to the changing market conditions.

Issue disposition: The Forest recognizes the merchantability problems associated with the salvage of burned timber. The proposed action has been revised to focus salvage harvest on fire caused tree mortality in areas of low and moderate burn intensity. These are areas where trees have died due to stem heating, root damage and subsequent bark beetle attack. The revised proposed action will generally exclude areas of high burn intensity and charred trees. Charred trees with heavy checking will not be considered merchantable material.

Minimize harvest operation timing restrictions: Time restrictions on harvest operations should be minimized to allow the purchaser to remove the timber before it deteriorates due to rot and insect activity. There is a limited amount of time that much of the timber will have value for sawtimber products. Harvest operations during the winter and spring may not be practical due to deep snow cover or wet ground conditions. Restrictions during hunting seasons could impact operations when field conditions are favorable for harvest operations.

Issue disposition: Harvest timing restrictions will be minimized to the extent practicable while still providing for the safety of all area users and the protection of project area resources.

Definition of dead and damaged trees to be included for salvage harvest: The project should define the fire damaged trees that would be removed. Trees that are damaged and likely to die should be included for harvest.

Issue disposition: The proposed action includes a definition of the trees to be included for harvest. This definition will include fire damaged trees that are likely to die, trees that will die due to secondary fire effects and mountain pine beetle infestation.

Alternatives, Including the Proposed Action

This chapter describes and compares the alternatives considered for the Rat Creek Salvage project. It includes a description and map of Alternative 2. This section also presents the alternatives in comparative form, sharply defining the differences between each alternative and providing a clear basis for choice among options by the decision maker and the public.

Alternatives Considered in Detail

Alternative 1 - No Action

Under the No Action alternative, current management plans would continue to guide management of the project area. No additional salvage harvest activities would be implemented to accomplish project goals.

Alternative 1 allows for management activities approved in previous decisions to take place; however, no new management activities would be initiated. Apart from ongoing and previously approved activities, Alternative 1 would allow ecological processes to control vegetative recovery. Ongoing activities within the Rat Creek wildfire area include cutting and removal of roadside hazard trees along 20 miles of roads, in accordance with Forest Supervisor Bruce Ramsey's May 19, 2008, Rat Creek Roadside Hazard Reduction Decision Memo (USDA Forest Service 2008d).

Alternative 2 - Proposed Action

The proposed action is to salvage harvest dead and dying trees within the Rat Creek fire perimeter on 35 units ranging in size from 3 to 320 acres. Trees that have died or are likely to die as a direct result of fire (due to secondary fire effects), and trees that will die due to insect attack or disease would be harvested. The units total approximately 1,652 acres (approximately 6 percent of the Rat Creek wildfire) and they burned with varying intensity. Tree mortality varies within the units due to the varying burn intensity, and trees that are expected to survive would remain unless they are infected with dwarf mistletoe. The harvest units are designed for logging using conventional, ground based harvest equipment such as rubber tired tractors. The units are generally located on slopes less than 35 percent. The proposed harvest units would result in 11 forest openings greater than 40 acres on lands suitable for timber production activities (USDA Forest Service 2009a).

Harvest units in the proposed action generally exclude areas of high burn intensity. The burned trees in these areas have become unmerchantable due to severe checking and insect attack. The proposed action focuses salvage harvest on dead and dying trees in areas that burned with moderate to low intensity. Tree mortality in these areas continues due to the direct effects of the fire, such as crown scorch, root damage and cambium damage. These areas are also experiencing mortality due to secondary fire effects, and insect attack.

Approximately 3 miles of existing or closed Forest System roads would be opened and reconditioned and approximately 7 miles of temporary roads would be constructed for project activities. Reconditioning would include maintenance of road drainage structures such as dips and culverts, clearing of trees and brush along the road right-of-way to provide a clear viewing distance and safe passage of vehicles, and surface blading to provide a smooth running surface and proper road drainage. All existing closed roads would be closed again following their use and all temporary roads would be obliterated after use. Temporary roads would be designed to limit

the need for excavation during construction and most would be located on areas of fairly gentle slope.

Trees to be included for salvage harvest are those 4 inches in diameter at breast height (DBH) and greater that have died or are likely to die due to direct fire effects, secondary effects, or mountain pine beetle attack. Trees with no live foliage (red-topped) and trees with defined levels of fire damage will be included for harvest. The probability of conifer survival is based on the amount of root crown based girdled by fire and the amount of live crown remaining. Guidance for the project fire damaged, but delayed mortality, tree removal was provided by three research documents which investigated tree mortality on similar forest types to those occurring on the project area (Scott, Szymoniak, and Rockwell 1996; Scott, Schmitt, and Spiegel 2002; Weatherby, Progar, and Mocettini 2001). Two areas are especially important to probability of conifer survival following wildfire. The amount of root crown base girdled by fire and the amount of live crown remaining after a fire greatly influence a trees' ability to survive. The following mortality/survival guidelines would be applied:

- Douglas-fir trees will be retained if at least 40 percent of pre-fire live crown exists and less than 33 percent of basal bole circumference is blackened.
- Lodgepole pine, Engelmann spruce, whitebark pine, and subalpine fir will be retained if at least 80 percent of pre-fire live crown remains and less than 33 percent of basal bole circumference is blackened.
- Trees with obvious sign of insect attack including pitch tubes or boring dust will be harvested. Lodgepole pine, Douglas-fir and spruce are the most likely species to be affected by beetle infestation within and adjacent to the burn.

Live trees may need to be cut to facilitate harvest operations. Live trees may be cut during landing, skid trail, or temporary road construction after designation by Forest timber sale administration staff. Live trees that pose a safety hazard to harvest operations may also be cut after designation by Forest timber sale administration staff.

Proposed harvest units are expected to be reforested within 5 years of harvest through natural regeneration. The forest regeneration on harvest units would be monitored until the sites are fully stocked. Most forest regeneration is expected to be lodgepole pine; however, there is a desire to maintain the diversity of tree species found prior to the wildfire. Supplemental planting of Douglas-fir would be planned on harvest units and suitable timber lands within the wildfire area where it could be expected to occur as a natural stand component. The regeneration on suitable forest lands that are Douglas-fir habitat types (Fischer and Clayton 1983) (2,418 acres) would be monitored.

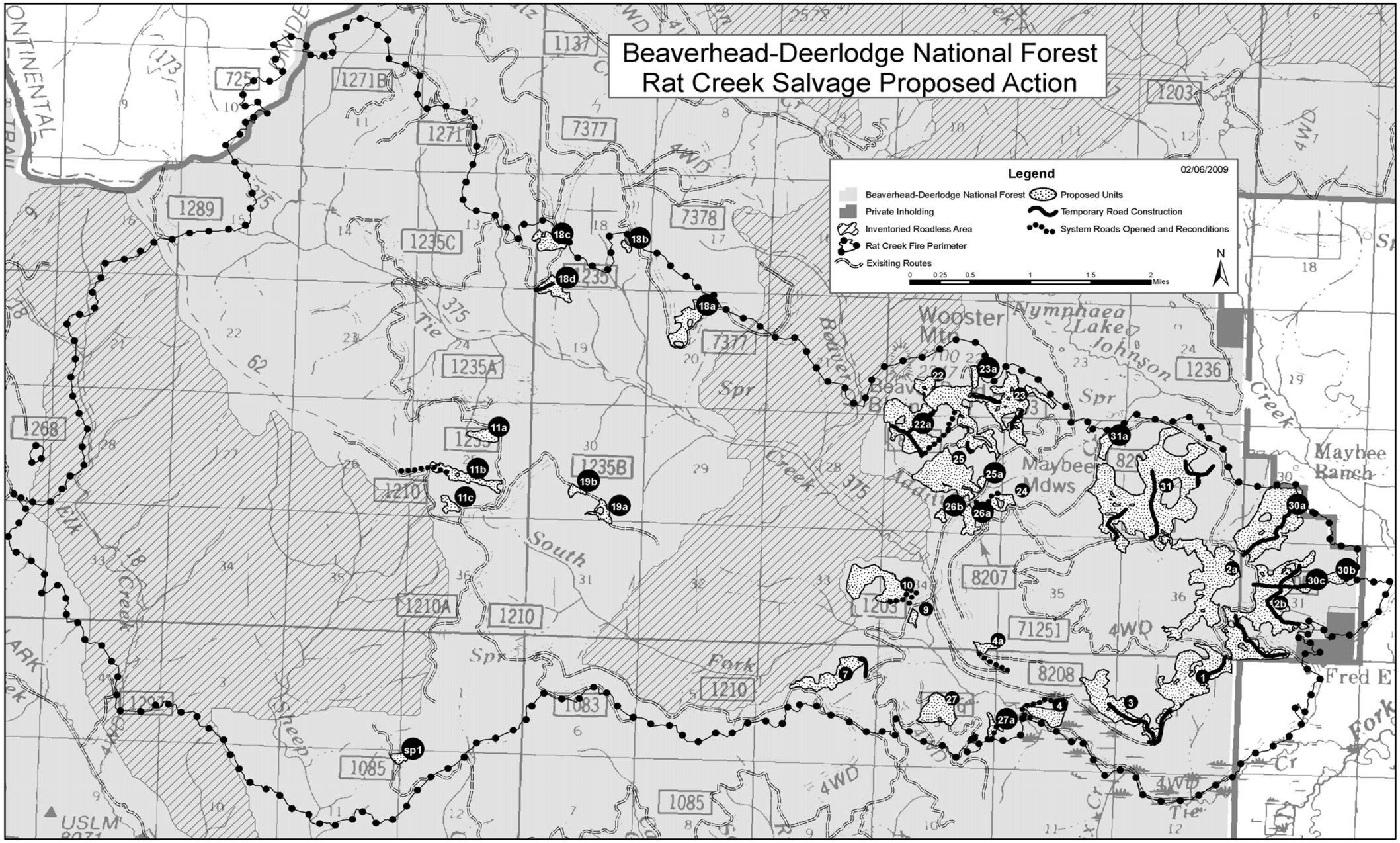

Figure 1. Rat Creek Environmental Assessment Alternative 2-Proposed Action

Alternatives Considered But Eliminated from Detailed Study

Address Travel Management (Decommission Forest System Roads)

An alternative to the proposed action that would decommission additional roads within the Rat Creek fire perimeter was suggested. This was proposed because many system roads may not be needed for management purposes for a long period of time, and road related resource impacts could be reduced by decommissioning much of the road network after salvage harvest. Roads that have seasonal closures could also be decommissioned to more effectively close them to motorized vehicle use. Travel management and road decommissioning not directly related to the project may be considered in the future, but not as an alternative to the proposed action because:

- Road based recreation is an appropriate use of project area roads based on Forest Plan recreation allocations. The project area is within Hunting Unit 321, which has a hunting season open motorized road and trail density objective of 1.1 miles per square mile and this objective is being met with current travel management (USDA Forest Service 2009a, p 49; USDA Forest Service 2009b).
- The proposed action includes road activities; however, no changes would be made in overall area travel management. Travel management is not part of the proposed action because all roads used for salvage harvest would return to current travel management status (USDA Forest Service 2009b).
- Travel management can be controversial and would require additional public input. Including road decommissioning as an alternative would increase the timeframe to complete the project.
- Travel management activities are not required to take place in conjunction with salvage harvest activities.

Harvest Additional Area

An alternative to the proposed action that would treat additional area with salvage harvest was suggested by the public. Suggestions included salvage harvest within Inventoried Roadless Areas.

This alternative will not be considered because:

- An alternative that increases the area of salvage harvest would take additional time to develop, analyze and implement. The deteriorating condition of the wood to be salvaged makes it necessary to move along with the proposed action and analysis.
- The Forest could pursue additional salvage harvest in a future project.
- Salvage harvest in Inventoried Roadless Areas may require the preparation of an environmental impact statement, which would extend the timeframe to complete the analysis beyond the time the salvage timber is expected to be merchantable.

Project Design Features

Project design features are listed below. These features were developed to reduce or eliminate adverse impacts from project activities, and are incorporated as an integrated part of the proposed action. Project design features are based upon standard practices and operating procedures that have been employed and proved effective in similar circumstances and conditions. Project design features prescribe measures that would reduce or eliminate potential adverse effects of the action alternatives, and are non-discretionary once approved in a decision.

Vegetation

- Live dwarf mistletoe infected overstory lodgepole pine less than 10 inches DBH within harvest units will be felled to reduce the spread of disease to the new stand. Dwarf mistletoe infected trees of commercial size may be removed during salvage harvest. Slash from the trees would be scattered on site or piled and burned at central log landings.

Fuels

- Nonmerchantable and submerchantable material, such as cull logs and tree limbs, within harvest units will be piled and burned so that total fuel loads do not exceed an average of 20 tons per acre across harvest units.

Air Quality

- All prescribed burning will comply with the State Requirements of the State Implementation Plan and the Smoke Management Plan (USDA Forest Service 1987a, p. II-26). Prescribed burning is reported to the Airshed Coordinator on a daily basis. If ventilation problems are forecast by the monitoring unit, prescribed burning is either restricted by elevation or curtailed until good ventilation exists (Dzomba 2005).
- A prescribed burn plan will be completed prior to any burning. The burn plan will address mitigation measures to minimize smoke impacts and to comply with state and federal air quality regulations.
- Best Available Control Technologies (BACT) will be implemented during prescribed burning operations to limit emissions to the maximum degree that Montana Department of Environmental Quality (MDEQ) determines for that source on a case by case basis. Techniques and methods may include, but are not limited to: scheduling burn periods, applying dispersion forecasts, fuel preparation and configuration, and limiting the amount of burning, ignition and burning techniques that minimize smoke production.

Weeds and Sensitive Plants

- Noxious weeds will be controlled following the procedures in the Noxious Weed Control Program Record of Decision (2002) for the Beaverhead-Deerlodge National Forest with the application of those Best Management Practices identified in the Beaverhead-Deerlodge National Forest Noxious Weed Control Final Environmental Impact Statement (2002) Appendix H.
- Ground disturbance will be minimized to limit noxious weed and undesirable plant establishment. Invasive plant treatments will occur during project operations and will continue for up to five years following completion of the project (USDA Forest Service 2002). Invasive plant treatments will be implemented at a time of year when the treatment is most effective.
- If any sensitive plant species are found during project implementation, a botanist will be consulted and the sensitive plants and their habitat will be protected.
- Vehicles and equipment utilized during project implementation will be cleaned and inspected for weeds prior to and following use to avoid transport of noxious weed seed and propagules.
- Timber sale contract provisions will require that all off-road logging and construction equipment is free of noxious weeds, when moving equipment onto sale area and/or

moving between units that are known to contain noxious weed. Provision B6.35-Equipment Cleaning will be included in the timber sale contract.

Wildlife

- All snags greater than 20 inches DBH will be retained. Snags greater than 15.0 inches DBH will not be harvested unless inventory shows there are in excess of 6.4 snags per acre, greater than 15.0 inches DBH, across the sum total acreage of all harvest units, or the sum total acreage of the burn perimeter. Snags in these size classes will be felled where they are a defined hazard to harvest operations and designated for felling by a Forest officer.
- Douglas fir snags are the first priority for retention where they occur, and Engelmann spruce are the second priority for retention. The remainder of snag retention needs will be lodgepole pine and subalpine fir. Spruce dominated riparian corridors, wet areas, and unmerchantable timber within harvest units (burned, defect, or smaller diameter), will contribute additional snag and coarse woody debris important to meeting wildlife habitat needs across the landscape.
- Motorized use of temporary roads and National Forest System roads opened (previously closed) for harvest access will be restricted to motorized travel required for timber harvest operations and Forest Service administrative use. These roads will not be open to public motorized use. These travel restrictions will maintain open motorized trail and road densities at desired levels (USDA Forest Service 2009a, p. 45-47).
- Previously active goshawk nest sites will be visited by the district wildlife biologist. If site visits indicate nesting is active, unit harvest activities will be postponed until after August 15th (units 31, 31a, and portions of 2b). A minimum 30-acre buffer will be delineated around the active nest and suitable habitat, and the buffer area will not be harvested.
- Harvest units will maintain the following minimum amounts of large woody debris: 6 pieces per acre 10 feet in length and the small end diameter equal to or greater than 8 inches in lodgepole pine cover type; 6 pieces per acre 10 feet in length and the small end diameter equal to or greater than 12 inches in Douglas-fir cover type (USDA Forest Service 2009a, p. 49).

Hydrology and Fisheries

- Harvest units and timber operations will avoid Riparian Conservation Areas (RCAs) (USDA Forest Service 2009a, p. 300) and seasonally wet areas. The Forest soil scientist, hydrologist, and fisheries biologist will work with the project implementation team to protect these areas.
- Project related storage of fuels and toxicants within Riparian Conservation Areas is prohibited. Refueling within Riparian Conservation Areas is prohibited except for emergency situations, in which case refueling sites must have an approved spill containment plan (USDA Forest Service 2009a, p 21).
- Harvest units, temporary roads, timber operations and project activities will avoid known western toad breeding sites and natal areas during breeding and juvenile rearing periods.
- Road stream crossings will have an appropriate, minimum size culvert. Temporary road culverts will be removed when harvest operations have been completed.
- Temporary roads will have water bars or other appropriate drainage structures. Minimum cross drain spacing will be determined by the road grade using the following formula:

1000 feet divided by the percent grade (i.e. 1000 feet ÷5 percent results in minimum 200-foot spacing).

Soils

- Harvest will not occur on slopes greater than 35 percent that have not had a site specific evaluation by a soil scientist determining that damage is unlikely (USDA Forest Service 2009a)
- Harvest will not occur on heavy-textured soils, found commonly in units, 1, 2a, 2b, 25a, 30a, the southern portion of the western leg of unit 23, and the southeastern legs of unit 25 until late summer when the soils have dried sufficiently as determined by the Forest Service (USDA Forest Service 1988, practice 13.06)
- There are draws that do not run water during the summer or fall in the central portion of unit 2b that have heavy-textured soils. Equipment will need to cross these draws on slash mats to avoid compaction and/or rutting.
- Space skid trails an average of 75 to 100 feet apart (USDA Forest Service 1988, practice 14.08). Skid trails should be adequately drained in order to prevent overland water flow. Slash should be placed on skid trails to prevent erosion and all-terrain vehicle (ATV) use (USDA Forest Service 1988, practice 15.25).
- Constructed skid trails and temporary roads will be obliterated and revegetated with native vegetation (USDA Forest Service, practice 15.25). Vertical cuts will be used on cutslopes to minimize surface disturbance.
- At least 12 tons per acre of coarse woody debris will be left in harvest units. This may be accomplished by felling and leaving trees where necessary (USDA Forest Service 1999).
- Landings will be revegetated with native seed and areas of compacted soil will be scarified prior to seeding (USDA Forest Service 1988, practice 14.11).
- Slash should be piled and burned on roads where feasible. Where this is not feasible slash will be piled in such a way (tall and narrow) as to reduce the footprint on the soil and piles will be burned when the soil is cold/frozen and moist.

Heritage

- If additional previously undiscovered cultural resources are discovered during project implementation, work will stop in that area immediately until a Forest heritage resource specialist can evaluate the site. The discovery must be protected until notified in writing to proceed by the authorized officer (36 CFR 800.110 & 112, 43 CFR 10.4).
- The timber sale contract will include standard provision B6.24 (or BT6.24), Protection Measures, regarding heritage protection measures.

Recreation/Scenery

- Roads and trails (including snowmobile trails) that pose a danger to forest users during harvest operations will be closed to the public. Advance notice and appropriate signs will be used to inform the public of the closures.
- No log hauling will occur on National Forest System roads on weekends and federal holidays from September 6th through November 30th to provide for public safety.
- Motorized vehicle travel will be restrticted to open motorized routes identified on the Forest Plan Interim Roads and Trails Inventory GIS layer (USDA Forest Service, 2009a,

page 53). Travel subsequent to harvest operations during restricted periods may be authorized on a limited basis.

Monitoring

- The project area will be monitored for noxious weeds and invasive plants. Monitoring will occur during project operations and will continue following completion of the project for up to five years.
- The forest regeneration on harvest units will be monitored following harvest to assure full stocking. Monitoring will continue until the units are certified as fully stocked. In addition, the regeneration on suitable forest lands that are Douglas-fir habitat will be monitored. Douglas-fir habitat that is not adequately stocked with Douglas-fir seedlings may be planted to achieve the desired species mix.
- A minimum of 10 percent of the harvest units (4 units minimum) will be monitored following the most recent version of the Soil Quality Disturbance Monitoring Protocol (USDA Forest Service 2009a).[1] Soil monitoring will include units 30b, 30c, 18b, and 18d.
- Post-harvest monitoring will determine compliance with Region 1 Soil Quality Standards (USDA Forest Service 1999).
- Temporary road construction and rehabilitation will be monitored to ensure project design features are adequate and compliance with Soil and Water Conservation Practices (USDA Forest Service, 1988).

Comparison of Alternatives

This section provides a summary of the effects of implementing each alternative. Information in Table 3 is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives.

Table 3. Comparison of Alternatives

Comparison Values	Alternative 1 No Action	Alternative 2 Proposed Action
Project Objectives		
Harvest Volume	0 CCF	24,700 CCF
Suitable Forest Lands in Managed Condition	0 acres	1,652 acres
Reforestation; acres monitored for fill-in Douglas fir planting need	0 acres	2,418 acres
Dwarf mistletoe sanitation	0 acres	1,652 acres
Issues		
Elk security	No effects	Short-term disturbance during harvest activities
Stream sedimentation	No sediment delivery for Tie Creek or Johnson Creek	No sediment delivery for Tie Creek or Johnson Creek

[1] Regional guidelines for pre- and post-harvest monitoring are currently in draft. Monitoring protocol may be revised to follow the most up-to-date Regional guidelines.

Comparison Values	Alternative 1 No Action	Alternative 2 Proposed Action
Transportation: temporary road construction[2]	0 miles	7 miles
Transportation: system roads opened[3]	0 miles	3 miles
Project Impacts		
Noxious weeds	No effects	Introduction and expansion
Plants: R1 sensitive	No loss of viability or trend to federal listing	No loss of viability or trend to federal listing
Plants: federally proposed, threatened or endangered	No effects	No effects
Wildlife: federally proposed, threatened or endangered: gray wolf, Canada lynx	No effects	**Gray wolf:** Not likely to jeopardize the continued existence or adversely modify proposed critical habitat **Canada lynx:** No effects. Habitat is unoccupied. Habitat linkages will be maintained.
Sensitive species	No impact	**No impact:** American peregrine falcon, flammulated owl, greater sage-grouse, harlequin duck, trumpeter swan, bald eagle, Great Basin pocket mouse, grizzly bear, pygmy rabbit, spotted bat, Townsend's big-eared bat **May Impact Individuals[4]:** black-backed woodpecker, fisher, North American wolverine, Northern bog lemming, western toad
Aquatic impacts	No effects to habitat or individual animals	No measureable negative effect on aquatic habitat or animals
Soil: projected average detrimental disturbance	0 percent	12.85 percent
Predicted Fuel loading, Year 2030	Fuels <3" 6-12 tons/acre Fuels >= 3" 25-40 tons/acre	Fuels <3" 4-8 tons/acre Fuels >=3" 10-20 tons/acre
Predicted wildfire resistance to control	High	Moderate
Air quality	No impacts	Short-term impacts in project vicinity
Inventoried Roadless characteristics	No affects	No affects
Recreation	No impacts	Short term impacts to dispersed recreation activities
Cultural and heritage resource	No direct or indirect impacts	No direct or indirect impacts
Project present net value	$0	$613,848

[2] Temporary roads will be closed to motorized vehicle traffic and obliterated after use.
[3] System roads opened for salvage harvest would be closed to vehicle use after use.
[4] May adversely impact individuals, but is not likely to result in a viability loss on the planning area nor cause a trend towards federal listing or a loss of species viability range-wide.

Environmental Consequences

This section summarizes the physical, biological, social and economic environments of the affected project area and the potential changes to those environments due to implementation of the alternatives. It also presents the scientific and analytical basis for comparison of alternatives presented in the chart above. Additional details regarding area conditions, analysis assumptions or methodology can be found in the individual resource reports located in the project record.

Cumulative Effects

According to the Council on Environmental Quality (NEPA) regulations "cumulative impact" is the impact on the environment which results for the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such actions (40 CFR 1508.7).

The relative boundaries, and past and planned activities assessed for cumulative effects vary by resource. Each resource cumulative effects area can be different and possibly larger or smaller. Relevant cumulative effects are discussed for each resource in this section. The cumulative effects analysis for each environmental component or resource area is guided by and consistent with the Council on Environmental Quality letter "Guidance on the Consideration of Past Actions in Cumulative Effects Analysis" as of June 24, 2005. A listing of relevant related past, present and future management activities in the Rat Creek Fire perimeter is provided in Appendix B. Sources of information for cumulative effects analysis include, but are not limited to: Forest GIS files (project GIS geodatabase: RatCr_NAD83_New_07152008_Geodatabase), Beaverhead-Deerlodge National Forest Schedule of Proposed Actions (2008d)

Silviculture

Alternative 1 – No Action

Direct and Indirect Effects

No vegetative management activities would occur at this time. There would be no utilization of trees that were killed, or those that will die as a result of the fire or mountain pine beetle infestation that are outside of the roadside salvage treatment zone, with the possible exception of wood removed through firewood permits.

There would be no treatment of residual, live dwarf mistletoe infected trees. These trees could infect the next stand of lodgepole pine, and disease incidence in young stands can be high. This is especially serious because seedlings and saplings are severely damaged by infection with even a few mistletoe plants. Those that survive for a few years often develop into little more than a single broom and resemble a bush or bonsai (Geils and Hawksworth 2002).

No fuels would be removed and no timber salvage would occur. Reduction of the existing fuel loading and breakup of fuel continuity would not occur. All fire-killed vegetation would remain on site and would eventually fall to the ground and add to the fuel load of the site.

Natural processes of recovery and vegetative succession would occur exclusively, with the regeneration of conifers taking place over a period of time. Through natural processes the stands would reforest mainly with lodgepole pine. There would be no planting of Douglas-fir to help diversify the species mix.

Cumulative Effects

Other than the possible potential for increased wildfires in the future due to the increased fuel loading, no cumulative effects from the no action alternative are known at this time.

Alternative 2 – Proposed Action

Direct and Indirect Effects

Implementation of this alternative would focus on removal and recovery of burned dead trees, trees infested with mountain pine beetle and merchantable trees not expected to survive 3 years following the fire, as well as live trees designated for removal for logistical or safety reasons. A sale administrator would identify lodgepole pines infected with dwarf mistletoe for cutting that are not already designated for removal. All material identified for removal down to 4-inch DBH would be harvested. Trees would be whole tree yarded to the landings.

Harvesting or cutting dwarf mistletoe infected trees would improve the health and growth of the new stand. Dwarf mistletoe impacts healthy lodgepole pines by creating growth defects. Dwarf mistletoe is a damaging disease agent in lodgepole pine, causing severe growth loss and increased tree mortality. Recent assessments of the effects of lodgepole pine dwarf mistletoe in Montana, Colorado, and Wyoming indicate that the annual loss exceeds 40 million cubic feet per year. Acceptable yields cannot be expected from stands infected when they are young. For example, 100-year-old stands that have been infected for 70 years average only 300 cubic feet (8 in) of wood per acre, while healthy stands of the same age on similar site averaged 2,350 cubic feet of wood per acre (Hawksworth and Dooling 1984). Dwarf mistletoe infected trees not cut during harvest operations would be cut in accordance to a supplemental silvicultural contract.

Natural processes of recovery and vegetative succession would occur following harvest, natural regeneration would be primarily lodgepole pine with limited Douglas-fir regeneration. All harvest units within the project area are expected to naturally regenerate. Typical third year stocking after a wildfire ranges from 100 trees per acre to 20,000 trees per acre with a median range of 1,000 trees per acre to 5,000 trees per acre (Schuelke, personal communication). All stands are expected to be fully stocked 5 years after completion of harvest activities.

The regeneration of harvest units would be evaluated to ensure objectives for reforestation are met. Stands with inadequate regeneration will be evaluated for fill-in planting, and may be planted with Douglas-fir to promote species diversity and forest health or lodgepole pine. Some seedlings are expected to be killed during the harvesting process. However, with several thousand seedlings expected to naturally regenerate and a minimum forest stocking of 200 trees per acre, it is expected that each harvest unit would have sufficient seedlings to consider the area fully stocked.

Historically Douglas-fir has had limited success regenerating naturally. Therefore, it is expected that planting would be needed to reestablish desired trees per acre for this species. Planting densities on sites for Douglas-fir would range from fill-in planting (planting a few trees per acre) to planting approximately 250 trees per acre on slopes with SW to SE aspects that vary in elevation from 7,600 feet down to 6,400 feet.

Prior to the burn, the project area included 1,008 acres of pine plantations. These units were predominately clear cuts with regeneration dates ranging from 1957 to 1994. At the time of the Rat Creek fire, these previously harvested units had successfully regenerated and were certified as fully stocked with predominately lodgepole pines varying in size from saplings in the younger

stands and small sawtimber in the older stands. The Rat Creek fire spotted within some of these units, and resulted in localized, patchy mortality where fire intensity was high. Those plantations inside the burn perimeter that have evidence of crown scorch or mortality would be evaluated to determine if supplemental planting of lodgepole pine or Douglas-fir is needed to restore stocking levels to acceptable levels.

Cumulative Effects

The effects of related past, present and reasonably foreseeable actions were considered for cumulative effects anticipated from the proposed action. The Tie-Johnson Management Area, 59,397 acres, was analyzed to determine the amount of vegetative management that has taken place. Historical records indicate that 7,570 acres of forest stands were harvested and regenerated from 1957 until 1994. These stands are now forested with sapling to small sawtimber size trees.

Since 1998 approximately 49,479 acres within the Tie-Johnson Management Area have burned as a result of wildfire. Approximately 53 percent of those acres are within the Sheep Creek and Rat Creek fire boundaries. These areas are still in the process of regenerating back to their former forest type. Due to past harvest and recent wildfires only 2,308 acres (harvest units and roadside units), less than 4 percent of the Tie-Johnson Management Area, remain untreated or unburned.

Currently, there is a mountain pine beetle (MPB) epidemic occurring on the Beaverhead-Deer Lodge NF, including the Tie-Johnson Management Area. The current epidemic is likely to kill several thousand acres of pole to sawtimber size lodgepole pines. It will take decades to return these acres to similar conditions prior to the fire and MPB epidemic. Forest stands impacted by the MPB epidemic rather than the fire may not produce as many seedlings per acre as units that were burned (USDA Forest Service 1990).

The combined effects of recent wildfires and insect caused mortality of the remaining overstory pine trees will transition over 80 percent of the watershed into early-seral stand conditions. The proposed salvage harvest of 1,652 acres would not change this transition.

Additional salvage sales across the forest could be expected as a result of the epidemic; although there are none occurring or planned at this time within the Tie-Johnson Management Area.

Since wildfires cannot be predicted no assumptions will be made concerning possible future wildfire events.

Compliance with the Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

The proposed salvage harvest is consistent with Forest Plan goals, objectives and standards for timber management and vegetation:

- Forest stands in harvest units are dead and dying (USDA Forest Service 2009a, p. 285-286), average expected mortality is 98 percent and salvage harvest is an appropriate silvicultural practice for these conditions (USDA Forest Service 2009a, p. 38).
- Salvage harvest would not occur on lands where timber harvest is not allowed (USDA Forest Service 2009a, p. 39).
- Eleven openings resulting from the proposed harvest are greater than 40 acres and on lands suitable for timber production activities. The dead and dying trees in the salvage units are the result of natural events; wildfire and subsequent insect caused mortality.

- The culmination of mean annual increment growth requirement does not apply to salvage harvest of timber stands which are substantially damaged by fire and insects (USDA Forest Service 2009a, p. 39).
- Proposed harvest units can be adequately restocked following harvest.
- Proposed salvage harvest would not take place in old-growth stands (USDA Forest Service 2009a, p. 295).

Plants

Introduction

The 2004 Region 1 sensitive plants list for Montana was used to identify sensitive plants on lands managed by the Beaverhead-Deerlodge National Forest, and species on adjacent Forests with high potential to occur on the Beaverhead-Deerlodge National Forest. Field surveys, knowledge of the botanical resources and habitats of the Big Hole and Rat Creek Fire area, and literature were the basis of the effects analysis. A geographic information system (GIS) that reflects known sensitive plant populations of the Beaverhead-Deerlodge National Forest and adjacent lands was used to assess potential populations within the analysis area, and the extent of occurrence for species detected within the analysis area (USDA Forest Service 2008c). Additional information regarding this effects analysis can be found in the *Rat Creek Salvage Project Sensitive Plants Biological Evaluation* located in the project file (Gibson 2008).

Spatial and Temporal Context for Effects Analysis

The geographic area for sensitive plants effects analysis includes the following area: from State Highway 43 in the south to Johnson Creek in the north; from Schultz Saddle in the north along the Continental Divide SSW to Prairie Creek; from Prairie Creek to the Lewis & Clark Trail SSW down Trail Creek to Hwy 43; and from Trail Creek in the west down Hwy 43 to the east to the Big Hole Battlefield and north 1 section east of the Forest boundary. A map depicting this area is available in the *Rat Creek Salvage Project Sensitive Plants Biological Evaluation* (Gibson 2008) available in the project file. This area was selected because it includes habitat for sensitive plants known to occur in the Rat Creek Fire area, includes the project area, includes recent post-fire salvage areas, is an area treated for weeds, and represents a spatial scale capable of detecting direct, indirect and cumulative effects of the proposed activities to sensitive plants. Watershed boundaries and perimeters of recent fires (Sheep Creek, Mussigbrod, and Rat Creek Fires), as well as inclusion of habitat associated with *Penstemon lemhiensis* on a larger scale than that of the Rat Creek Fire alone were criteria used to develop the extent of this analysis area.

Effects of the proposed action to sensitive plants would persist through the activity period (likely 2009-2011) and for 10 years following project completion (Davis et al. 1993). The effects to sensitive plants from noxious weeds and habitat loss associated with fire suppression and livestock grazing are of greater temporal depth than that of the proposed action because these effects are of greater severity and magnitude (Davis et al. 1993; Heyerdahl et al. 2006). Within 10 years, conifer recruitment and stand regeneration is anticipated to be within natural stages of succession that will shade noxious weeds, increasing competition for light and reducing noxious weed population densities that establish within salvage units.

Alternative 1 - No Action

Direct Effects

Livestock may directly browse or trample *Penstemon lemhiensis* individuals with implementation of the No Action Alternative. Individuals may be directly affected by accidental herbicide application associated with noxious weed treatment.

Indirect Effects

The combination of fire suppression and livestock grazing over the last century has resulted in conifer expansion into sagebrush—steppe grasslands that are habitat for *Penstemon lemhiensis* (Gruell 1983; Heyerdahl et al. 2006; MTHP 2008b). The introduction and expansion of noxious weeds also affects *Penstemon lemhiensis* across its range (MTHP 2008b). Timber harvest has occurred throughout the project area, altering *Allotropa virgata* (a former R1 sensitive plant) habitat and introducing noxious weeds. Post-fire mushroom harvesting in summer of 2008 will facilitate noxious weed expansion into the Rat Creek Fire area because of the presence of existing noxious weed populations along Hwy 43 and within the burned area (USDA Forest Service 2007b), as well as the nature of commercial mushroom hunting techniques (C. Gibson 2008). These effects to *Penstemon lemhiensis* populations and habitat threaten the health and vigor of populations within the analysis area and are anticipated to persist under the No Action Alternative.

Cumulative Effects

Potential effects of livestock browsing and trampling, accidental herbicide application, habitat change, and interspecific competition with noxious weeds cumulatively compromise the perpetuation of *Penstemon lemhiensis* subpopulations within the project area. At this time, these direct and indirect effects would occur as a result of random chance (i.e. livestock browsing) and with time (i.e. noxious weed expansion). Cumulatively these effects of the No Action Alternative would continue to impact two small subpopulations on the National Forest as well as larger populations on National Park Service managed land within the project area. Because there is no change to existing conditions with the No Action Alternative there is no additional increase in the likelihood of compromised viability of any R1 sensitive plant species, including *Penstemon lemhiensis* and populations of this species in the north Big Hole.

Summary of Effects

No federally proposed, threatened, or endangered plant taxa occur on the Beaverhead-Deerlodge National Forest, so no direct, indirect or cumulative effects to federally proposed, threatened, or endangered plant species would occur with selection of the No Action Alternative. Direct, indirect and cumulative effects to R1 sensitive plant species associated with the No Action Alternative would occur as a result of random chance and with time. Therefore, No Action Alternative would not lead to loss of viability or trend to federal listing of any R1 sensitive plant species.

Compliance with the Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

Maintenance or restoration of sensitive plant populations and sensitive plant habitat is an objective in the Beaverhead-Deerlodge National Forest Plan (USDA Forest Service 2009a). The No Action Alternative would meet this objective because known noxious weed populations on the Lower Tie Creek Road would be treated to conserve small *Penstemon lemhiensis* subpopulations in the project area.

Alternative 2 - Proposed Action

Direct Effects

Direct effects to R1 sensitive plants within the proposed activity area would be similar to those described in the *Alternative 1 - No Action* section above.

Indirect Effects

Noxious weed introduction and expansion would be expected with selection of the Proposed Action Alternative. Increased road density, traffic, activity and ground disturbance associated with timber salvage would create new noxious weed vectors, transport noxious weed propagules, and facilitate increased noxious weed population density and occupied area (Bais et al. 2003, Kelsey & Locken 1987, Shelly et. al. 2002). Within 10 years, conifer recruitment and stand regeneration is anticipated to be within natural stages of succession that will shade noxious weeds, increasing competition for light and reducing noxious weed population densities that establish within salvage units. Harvest units and roads would be monitored for noxious weeds and invasive plants during harvest operations and for five years following harvest. Noxious weeds would be controlled following the procedures in the Noxious Weed Control Program Record of Decision (2002) for the Beaverhead-Deerlodge National Forest.

The increase in weed presence within the project area would have a negative, indirect effect to *Penstemon lemhiensis* populations on National Forest System lands that are in close proximity to proposed activity areas by way of interspecific competition associated with allelopathic capabilities and opportunistic nature of noxious weed species within and in close proximity to the Rat Creek Fire (Bais et al. 2003; Kelsey & Locken 1987; Gibson 2008, map 1). These indirect effects would likely be present on the landscape for a minimum of 10 seasons after timber salvage operations are complete and before coniferous vegetation are reestablished (Davis et al. 1993). Additional indirect effects to R1 sensitive plants within the proposed activity area are those described in the Indirect Effects – No Action Alternative section above.

Cumulative Effects

Potential effects of livestock browsing and trampling, accidental herbicide application, habitat change, and interspecific competition with noxious weeds cumulatively compromise the perpetuation of *Penstemon lemhiensis* subpopulations within the analysis area. There is an increased risk of noxious weed introduction and establishment but this would be mitigated by monitoring and weed control measures. At this time, these direct and indirect effects would occur as a result of random chance (i.e. livestock browsing) and with time (i.e. noxious weed expansion). Cumulatively these effects of the Proposed Action Alternative would continue to impact the two small subpopulations on the National Forest as well as larger populations on National Park Service managed land within the analysis area. The increased threat to log term viability of any R1 sensitive plant species, including *Penstemon lemhiensis* and populations of this species in the north Big Hole is considered minimal.

Summary of Effects

Since no federally proposed, threatened, or endangered plant taxa occur on the Beaverhead-Deerlodge National Forest (USDA 2004); no direct, indirect or cumulative effects to federally proposed, threatened, or endangered plant species would occur with selection of the Proposed Action Alternative. Direct, indirect and cumulative effects to R1 sensitive plant species associated with the Proposed Action Alternative would occur as a result of random chance. Therefore, the

Proposed Action Alternative would not lead to loss of viability or trend to federal listing of any R1 sensitive plant species.

Compliance with the Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

Maintenance or restoration of sensitive plant populations and sensitive plant habitat is an objective in the Beaverhead-Deerlodge National Forest Plan (USDA 2008b). The Rat Creek Salvage Project would meet this objective because timber extraction would be limited to conifer dominated locations and known noxious weed populations near *Penstemon lemhiensis* subpopulations adjacent to proposed units would be monitored and treated.

Threatened, Endangered and Proposed Species and Designated Critical Habitat

On July 21, 2008, the U.S.D.I. Fish and Wildlife Service in Helena, Montana supplied a list of Threatened, Endangered, Proposed (TEPs), and Candidate species applicable to the Beaverhead-Deerlodge National Forest. This list was reviewed online for the Beaverhead-Deerlodge National Forest and Beaverhead County (USDI Fish and Wildlife Service 2008), http://www.fws.gov/montanafieldoffice/Endangered_Species/Listed_Species.html). Gray Wolf was the only wildlife species on the list that may occur and/or has suitable habitat within the Big Hole Landscape. It is designated as a nonessential experimental population on this portion of the Beaverhead-Deerlodge National Forest. Also on the list are bull trout (threatened), which does not occur within watersheds of the project area, and yellow-billed cuckoo western population (candidate), which does not occur in the project area, only west of the continental divide in cottonwood riparian areas. The project area is also well outside the boundary of the grizzly bear (Yellowstone Distinct Population Segment (DPS)). Grizzly bear and Canada lynx (threatened species) are not reasonably expected to occur within Beaverhead County, including the project area, and therefore are not included on the list of TEPS being analyzed in further detail. Additional information regarding the TEPs analysis can be found in the *Rat Creek Salvage Sale Biological Assessment/Biological Evaluation/Wildlife Specialist Report* (Kozlowski 2009) located in the project file.

Gray Wolf

Direct and Indirect Effects

Three factors can be used to evaluate the direct and indirect effects on wolves from forest management and vegetative treatments: (1) potential wolf/human interaction; (2) effects on the wolf prey base; and (3) impacts to the integrity of key wolf habitat (e.g., rendezvous and den sites).

No new system roads would be constructed; however, there would be a small and temporary increase in road use associated with the administrative and permitted use of currently closed roads (3 miles) and the new temporary roads (7 miles). Currently closed system roads would remain closed to public use during harvest activities. Gates or other barriers would be put in place to close system roads opened for use during the project within one season following project activities. Temporary roads would be permanently abolished through scarification, re-contouring, and covering with debris to discourage establishment of motorized vehicle use. They are expected to naturally revegetate with grasses and forbs within two years, and tree seedlings should re-

establish within five years. Although there would be a temporary increase in road use associated with the active harvest period (one or two seasons), public access and use of roads would not measurably change, and project related use of roads would be of short duration (one or two years) before they are again permanently closed. The small change is not likely to result in an increase in human caused wolf mortality or a substantial change in habitat use by ungulates.

The proposed action would have minimal impacts to key wolf habitats such as meadow complexes, which serve as potential den sites, rendezvous sites, and areas where prey (ungulates) concentrate. Habitat within densely forested portions of the burn perimeter have been heavily impacted from wildfire, which has temporarily degraded the overall quality of such habitats until forest vegetation regenerates and provides suitable cover. Tree removal activities are focused on dead or dying timber within the larger burn perimeter and outside of riparian areas; therefore, these activities are unlikely to remove or degrade areas where wolves might den, rendezvous, or encounter available prey. The implementation of the proposed action would not appreciably change population size or distribution of wolf prey, nor remove available key habitats.

Cumulative Effects

Endangered Species Act regulations define the "effects of the action" to include: *direct and indirect effects of an action on the species or critical habitat, together with effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline.*

In addition to the effects of the proposed action, cumulative effects to wolves may occur from recreational access such as snowmobile use in the Big Hole Landscape, persecution by big game hunters, accidental trapping mortality, control actions taken to protect livestock, and previous harvest activity in the Tie-Johnson Management Area. Despite these other activities, breeding wolf populations continue to persist within and around the Big Hole Landscape and successfully contribute to wolf recovery. The minimal effects of the proposed project, combined with interrelated and interdependent activities, would not result in an overall change to wolf occupation or breeding (see determination rationale below).

Determination of Effect

The proposed project is **"Not likely to jeopardize the continued existence of the gray wolf or adversely modify critical habitat (none is present)"** (Kozlowski 2009).

This determination is supported by rationale disclosed in the *Rat Creek Project Biological Assessment* (Kozlowski 2009), including:

- Gray wolves in the project area are within the Northern Rocky Mountain Distinct Population Segment designated by the U.S. Fish and Wildlife Service and are within the boundary managed as a non-essential experimental population.
- The project would not increase public access, would not modify the condition of potential rendezvous or denning habitat, and would not modify the availability of ungulates as prey. The project would have minimal to no effect on limiting factors for gray wolves.
- The combined direct, indirect, and cumulative effects to wolves are minimal, and would continue to maintain breeding pairs and occupied habitat, pertinent to recovery goals.
- The Northern Rocky Mountain Gray Wolf Population continues to expand in size and distribution, and exceeds original recovery goals.

Compliance with the Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

The proposed action alternative is consistent with Forest Plan direction for federally listed species. The Northern Rocky Mountain Gray Wolf Recovery Plan was considered during the design and analysis of this project. This project is located outside of the northwest Montana (gray wolf) recovery area.

Sensitive Species

Sensitive species for the Wisdom Ranger District of the Beaverhead-Deerlodge National Forest and their habitats were evaluated for this project, including species on the 2004 Northern Region Sensitive Species List (2004). A detailed narrative follows for species potentially affected by the project, with the exception of the western toad which is discussed in the *Fish and Aquatic* habitat section of this document. Those species that would clearly not be impacted because they do not occur on the forest or the habitat they occupy would not be modified include: harlequin duck, greater sage-grouse, Columbian sharp-tailed grouse, flammulated owl, burrowing owl, trumpeter swan, common loon, greater basin pocket mouse, grizzly bear, pygmy rabbit, and northern leopard frog. Westslope cutthroat trout and fluvial arctic grayling do not occur within the project area or immediately downstream. Additional information regarding the sensitive species analysis can be found in the *Rat Creek Salvage Sale Biological Assessment/Biological Evaluation/Wildlife Specialist Report* (Kozlowski 2009) and *Rat Creek Salvage Biological Evaluation of Sensitive Species Specialist Report* (Brammer 2009 located in the project file.

Peregrine Falcon

Effects Analysis

Suitable nesting habitat is not present, and salvage logging and associated activities would not alter the availability of prey (songbirds) to occasional falcons that may be migrating through or temporarily foraging on the landscape. There would be no direct, indirect or cumulative effects caused by the implementation of the proposed action.

Determination

The proposed action would nave **no impact** on peregrine falcon because of the lack of suitable nesting habitat. Songbirds are expected to continue to inhabit the project area and would be available as potential prey for occasional migrating or foraging falcons (Kozlowski 2009).

Black-backed Woodpecker

Effects Analysis

Direct and Indirect Effects

The proposed action would treat approximately 1,652 acres of burned forest. Of these treatment units, approximately 37 acres are located within identified quality habitat patches over 200 acres in size. a small portion of these larger patches are proposed for treatment and the resulting patch sizes remain over 200 acres; therefore, these treatments would not detract from the overall effectiveness of the large patches as quality nesting habitat and suitable territories. Another 128 acres of additional habitat will be affected by the harvest units; however, these effects occur in habitat patches that are already smaller than the 200 acres in size so are moderate in quality as nesting habitat/territories. Foraging habitat within harvest units will continue to be available associated with the patchy distribution of snags, retention areas, and unmerchantable timber.

Foraging habitat associated with unharvested areas would remain well over 20,000 acres within the burn perimeter. Table 4 below shows the proposed harvest units and the acres of black-backed habitat affected by each treatment.

Table 4. Black-backed Woodpecker Habitat by Harvest Unit

Harvest Unit	Acres of black-backed habitat affected.	Type of Habitat	Is habitat patch size largely reduced in size?
22a	35 acres out of 539 acres available	Quality Habitat	No
18c	2 acres out of 204 acres available	Quality Habitat	No
1	35 acres out of 104 acres available	Moderate Habitat	Moderate reduction.
2b	28 acres out of 43 acres available	Moderate Habitat	Affects several small patches of unconnected habitat
31	16 out of 133 acres available	Moderate Habitat	No, small reduction in overall patch size.
26a	15 out of 68 acres available	Moderate Habitat	Moderate reduction
31a	12 out of 133 acres available	Moderate Habitat	No, small reduction in overall patch size.
25	11 of 11 acres available	Moderate Habitat	No, patch size is too small.
24	8 of 16 acres available	Moderate Habitat	No, original patch size is small.
Sp1	1 acre	Moderate Habitat	No
27	1 acre	Moderate Habitat	No
11b	1 acre	Moderate Habitat	No
All other units	1,487 acres of 22,600 available	Additional Black-backed Habitat	No, 22,600 acres prior to harvest.

Cumulative Effects

Vegetation removal projects related to the Mussigbrod Fire, Sheep Creek Fire, and Road-side Hazard Tree Removal amount to a maximum of 1,356 acres of potential black-backed woodpecker habitat previously removed from the Tie-Johnson management area. The Rat Creek Salvage Project proposes to harvest an additional 1,652 acres of potential habitat. The layout of the Rat Creek Salvage project avoids the loss of quality habitat patch sizes greater than 200 acres. When considering that the Mussigbrod Fire, Rat Creek Fire, and Sheep Creek Fire created approximately 50,000 acres of habitat across the Tie-Johnson Management area, and that over 20,000 acres would remain intact within the recently burned but unharvested areas of Rat Creek, negative cumulative effects to the black-backed woodpecker and its habitat are not expected to occur. Potential foraging and nesting habitat for black-backed woodpeckers is abundant and widespread across the Beaverhead-Deerlodge National Forest, and in Region 1, and is expected to continue to increase.

Determination

Implementation of the proposed action **may impact individual black-backed woodpeckers, but would not threaten the viability of the black-backed woodpecker nor cause a trend towards federal listing** (Kozlowski 2009). This determination is supported by the following rational:

- The Rat Creek Fire (2007) created an estimated 25,600 acres of habitat available to black-backed woodpeckers. Over 23,900 acres of this habitat is expected to persist (unharvested) and be widely distributed following implementation of the proposed action.
- Four large patches of habitat (1,321 acres total, each greater than 200 acres) have been identified as quality habitat and potential breeding territories. These patches would remain intact after harvest since only 37 acres would be treated.
- Additional moderate quality habitat (1,657 acres) has been identified and is widely distributed in patches less than 200 acres in size. Of these moderate quality habitat patches, 128 acres would be treated, indicating a small reduction (8 percent) in available moderate quality habitat.
- Riparian buffers, snag retention standards, unmerchantable timber, and green tree areas with insect activity would continue to provide widely distributed foraging areas.
- Recent fires and insect epidemics within the last 10 years have been numerous in adjacent landscapes. Estimated habitat on the forest (and in the region) exceeds the viability estimate of 29,000 acres cited by Samson (2006).

Bald Eagle

Effects Analysis

The project does not occur within nesting or wintering habitat of the bald eagle, and stream conditions would not be modified in a manner that would limit the availability of fish as prey. Eagles are most commonly affected by disturbance to nests and young, disturbances in wintering areas, decreases in food supply, and illegal shooting. No such effects would occur as a result of the proposed project or alternatives.

Determination

The proposed action alternative would have **no impact**. There is no suitable nesting or wintering habitat. Use of the project area by bald eagles is limited to occasional opportunistic foraging along small streams. The availability of fish or other wildlife as occasional prey would not be reduced (Kozlowski 2009).

Fisher

Effects Analysis

Direct and Indirect Effects

Although rare, fisher may be present in portions of the Tie-Johnson Management Area most likely at low to mid elevations along drainages. Fisher are directly or indirectly affected through disturbance and displacement, changes in the amount of suitable habitat, and through trapper access. Timber harvest can fragment fisher habitat, reduce it in size, or change the forest structure to be unsuitable for fisher.

Potential fisher habitat has declined in all burned areas. A substantial amount of canopy cover along drainages and adjacent forested habitat has been reduced by wildfire activity; thus limiting green tree forests with large diameter trees, dense canopy, multi-story stand structure, and continuous vegetative cover. Remaining suitable habitat is restricted to riparian corridors where fire effects were minimal. Fisher habitat, at current conditions, is limited within the burn perimeter, and will naturally continue to decline for a period of years as damaged trees die, lose their canopy, and the area transitions to an early seral forest. At the landscape scale, the FEIS for the Forest Plan (2009) demonstrates that the Big Hole Landscape retains approximately 88 percent of its forested areas without recent harvest or fire disturbance. Thus, suitable habitat will persist in abundance across the landscape in mature and late-seral forests.

Table 5. Estimated Harvest and Burned Areas Approximately 1950- to present (USDA Forest Service 2009b)

Landscape	Percent of Area Harvested	Percent of Area Burned	Percent of FS portion with >60% Crown Removal
Big Hole	5.3	6.0	11.8

Removal of 1,652 acres of dying timber is unlikely to alter the available habitat conditions for a particular individual animal, because the species is known to be uncommon in this portion of the Montana landscape, and has a territory size ranging from 4,500 acres to near 20,000 acres. Well developed riparian corridors, the habitat that fisher are most likely to use, are outside of proposed harvest units and would be retained as streamside buffers. Their value as habitat to fisher would not be reduced. Removal of fire-killed trees in upland harvest units reduces the number of snags potentially available to fisher as cavities useful for denning or foraging; however, the harvest units make up a small portion (6 percent) of the burned area. The remaining 94 percent of forested stands within the burn perimeter would continue to be available as potential fisher habitat; though the value of that habitat has been reduced by wildfire. Harvest units would only occur in currently dead and dying stands, or those predicted to have mortality soon after from beetle infestations. Therefore, their potential as fisher habitat is short-lived as they would soon convert to an early-successional stage. Snag retention standards would mitigate the small and temporary loss of habitat by maintaining all available snags greater than 20 inches within each harvest unit, and ensuring that on average across the burn perimeter, over six snags per acre would be retained that are greater than 15inches DBH. Additional snags would be provided by retention of Douglas-fir 18 inches or larger, and retention of non-merchantable timber from defect and fire damage.

Cumulative Effects

At the scale of the Beaverhead-Deerlodge National Forest, cumulative effects that have the potential to affect fisher include: loss of habitat through past timber harvest, potential future wildfire, a high density of roads open to motorized use, and trapping. Mature forest that serves as fisher habitat has not experienced much impact from timber harvest or wildfire over the last 50 years. As seen in the table below prepared for the Forest Plan Revision, impacts at the forest scale have been small. Forested portions of the Beaverhead-Deerlodge are fundamentally intact and will continue to serve as fisher habitat.

Table 6. Estimated Harvest and Burned Areas on the BDNF, approximately 1950- to present (USDA Forest Service 2009b)

Landscape	Percent of Area Harvested	Percent of Area Burned	Percent of FS portion with >60% Crown Removal
Pioneer	1.9	0.2	2.6
Big Hole	5.3	6.0	11.8
Upper Rock Creek	5.0	4.2	9.6
Upper Clark Fork	4.0	0.0	4.8
Boulder River	4.1	1.5	6.3
Jefferson River	0.7	0.0	1.5
Tobacco Roots	2.6	0.0	3.3
Gravelly	3.0	0.5	3.9
Madison	0.1	0.0	0.2
Lima Tendoy	0.9	0.0	1.3

Large snags are in plentiful supply across the forest and are expected to be maintained at the current levels. Old growth habitat is well distributed across the Forest. The Forest Plan directs that mechanical vegetation treatments and prescribed fire in old growth stands do not reduce the age and number of large trees and basal area below the minimum criteria required for Eastern Montana old growth in Green et al (1992), Table 3. Stands that do not meet the minimum criteria in are not considered old growth.

Trapping pressure is the responsibility of Montana Fish, Wildlife, and Parks. Though fisher are legally trapped in Montana, there are no recent records of fisher being trapped in the nearby landscapes.

Open motorized roads and trails under the Forest Plan will be reduced by approximately 392 miles (across the Forest). Vehicular disturbance associated with roads will decrease. Road density objectives by landscapes will maintain a relatively undeveloped Forest at the individual landscapes as well as the Forest-wide scale.

Predominant road density objectives under the Forest Plan are less than 1.5 miles per square mile of open motorized roads and trails. Adverse effects to fisher from human disturbance would not occur at the Forest scale.

Determination

The proposed action alternative **may impact individual fisher**, but those impacts, if they occur at all, would be minimal, and **would not threaten the viability of fisher in the planning area nor cause a trend towards federal listing** (Kozlowski 2009). The rationale for this determination includes:

- Fisher are naturally uncommon in the landscape due to higher elevations, steep topography, and powdery snow conditions which do not favor occupancy by fisher. Fisher may not be present at all.
- The biggest impacts to habitat occur from natural effects of the Rat Creek fire in 2007. These effects will result in a majority of upland forest/habitat (within the fire perimeter) being converted to early successional stages over the next 20 years. However, the remainder of the Big Hole Landscape and other portions of the Beaverhead-Deerlodge

National Forest will continue to provide for widespread mature and late-seral forest conditions suitable as fisher denning and foraging habitat.

- Salvage in upland harvest units would remove a number of dead trees potentially available to a fisher as cavities useful for denning or foraging. However, the harvest units make up only 6 percent of the burned area. The remaining forest stands within the burn perimeter will continue to be available as potential fisher habitat, though the value of the that habitat has been reduce by wildfire.
- Within the burn perimeter, habitat will persist along forested stream corridors where burn intensity was less severe. Also, harvest does not occur in forested stream corridors, the most likely occupied fisher habitat, as these areas are included in riparian buffers.
- Snag retention, old growth retention, unharvested areas within the burn perimeter, no net increase in existing open roads, and a relatively unroaded Big Hole Landscape, would ensure that fisher continue to have habitat for travel, foraging, and denning widely distributed within the burn perimeter and in adjacent forested areas.

Wolverine

Effects Analysis

Direct and Indirect Effects

Wolverine may utilize habitat in the Rat Creek burn perimeter as part of a larger home range, or more likely, as a linkage corridor between home ranges to the North and South. A majority of the habitat within the burn perimeter will undergo changes from mature forest to early-successional stages. Wolverine will continue to concentrate use in unroaded habitat including the Anaconda-Pintler Mountains, the Beaverhead Mountains, and the Pioneer Mountains. The Rat Creek burn perimeter will provide travel cover and foraging opportunities; however, the relatively high road density compared to surrounding landscapes and its smaller size, limits values needed to support individual wolverine.

Removal of the fire-killed trees under the proposed action would not affect the prey base or potential denning habitat of wolverine. Treatment units may reduce cover as travel habitat for wolverine; though such cover is not limited in the Rat Creek burn perimeter or in the Tie-Johnson Management Area. Negative effects are unlikely, and if they occurred would be marginal and limited to wolverines selecting different drainages or forested stands as they move through the treatment area to avoid contact with ongoing logging operations.

Cumulative Effects

Reviewed at the scale of the Beaverhead-Deerlodge National Forest, cumulative effects to wolverine will be influenced positively by Forest Plan directions which include forest-wide reductions in motorized vehicle activity. Restrictions on motorized use within wolverine denning habitat will be implemented, and open motorized road density objectives will average less than 1.5 miles per square mile. No road building occurs in modeled denning habitat. Suitable timberland (proposed for commercial harvest) is reduced from 646,000 acres forest-wide to 299,000 acres. This will reduce the frequency of regeneration cuts in wolverine summer habitat. Previous and ongoing timber sales (Sheep Creek, Road-side Hazard Tree Removal, and existing early-seral Forest (from earlier sales) has not reduced the capability of the Tie-Johnson Management area to function as wolverine habitat. Overall wolverine population is regulated by Montana Fish Wildlife and Parks trapping regulations and enforcement.

Determination

The proposed project **may impact individual wolverines; however, it would not threaten the viability of wolverine nor cause a trend towards federal listing**. The rationale for this determination includes (Kozlowski 2009):

- The species success depends primarily on the availability of prey, denning habitat, and reduced human access at a scale much larger than the proposed treatment area. As a result, salvage timber harvest and associated activities at the scale of 1,652 acres would not alter the overall condition of availability of habitat or prey within an individual wolverine territory. During summer foraging activities, individual wolverine may make small temporary adjustments on how/where they use the landscape to avoid ongoing harvest activities and large openings created within salvage units.
- Denning habitat, normally associated with high elevation cirques and talus slopes, is not adjacent to the project treatment areas and would not be affected by the project.
- Within the burn perimeter, wolverine habitat would persist in its current condition along forested stream corridors where burn intensity was less severe and tree/snag diameters are largest. Harvest would not occur in these forested stream corridors which are designated as Riparian Conservation Areas in the Forest Plan.
- Snag retention, old growth retention, unharvested areas within the burn perimeter, no net increase in existing open roads, and a relatively unroaded Big Hole Landscape, would ensure that wolverine continue to have habitat for travel, foraging, and denning widely distributed within the burn perimeter and in adjacent forested areas. Links between habitat in the Beaverhead Mountains and the Anaconda-Pintler wilderness would be maintained.
- The Forest Plan directs reductions in open road density, motorized winter recreation in denning habitat, and commercial timber harvest goals. In addition, standards would apply that maintain snags and old growth vegetation across all landscapes.

Northern Bog Lemming

Effects Analysis

Direct and Indirect Effects

Within the project area three observations of northern bog lemming are recorded and are associated with Maybee Meadows and Tie Creek. Potential habitat includes large wet meadows and associated riparian corridors. Negative effects to bog lemming or their habitat due to the proposed action alternative are unlikely; however there is some potential for individual lemming to be killed from heavy equipment or yarding/skidding of materials.

- Harvest units 23, 24, and 25a are near Maybee Meadows, an area of known occupied bog lemming habitat.
- Harvest units 23 and 25a are distinctly separated from bog lemming habitat by an existing open road. Mesic forested habitat associated with Maybee Meadows that might support occasional use by bog lemming is well outside of the harvest units. All harvest activities on these units will be confined to the North side of the road to eliminate potential effects to bog lemming.
- Harvest Unit 24 is located predominately in the upland which does not support bog lemming. Logging activities at the base of the hill, alongside Maybee Meadows, do have

some potential to kill individual northern bog lemmings during heavy equipment operations and when yarding/skidding trees. To mitigate the possibility of this unlikely effect, all harvest, yarding, and hauling operations will remain on the southeast side of the existing road. Operations will remain outside of primary habitat consisting of the riparian area with boggy meadows, sedges, and grasses as well as the spruce riparian corridor or wet lodgepole pine sites. Potential effects, though unlikely, will be limited to occasional individual animals that might stray on the edges of habitat.

Cumulative Effects

Past timber harvest units on the Beaverhead-Deerlodge National Forest did not typically contain bog/fen habitats, but did include some mesic spruce types. Since bog lemming habitat in Montana is primarily bog/fen, past avoidance of bog/fen habitats suggests that past management activities did not substantially reduce northern bog lemming habitat or populations.

Bog lemming can also be directly affected by motorized and/or snowmobile use. Summer off-road motorized use is prohibited Forest-wide; thus expected effects from this activity are minimal. Buck and pole fencing has been constructed at existing roads adjacent to Maybee Meadows to prohibit off-road travel in the area. Effects from off-road snowmobile use in Maybee Meadows are not quantified. Some snowmobile use does occur there; however, the meadow is not a snowmobile destination. More typically, snow machines proceed along the road to higher elevations where large expanses of open meadows occur. Livestock can also disrupt habitat when concentrated use occurs in wet boggy meadows. Livestock use is monitored routinely within each pasture, and is adjusted by Forest Service personnel in order to maintain proper functioning stream and riparian conditions, which in turn protect habitat for riparian species including northern bog lemming. The Tie-Johnson Cattle and Horse Allotment has been vacant approximately half of the last 10 grazing seasons to allow vegetation recovery after the Mussigbrod and Rat Creek fires.

Meeting aquatic standards in the Forest Plan (as analyzed in the aquatic resource report) will maintain proper functioning stream and riparian conditions which in turn, protect habitat for riparian species including northern bog lemming.

Determination

The proposed action alternative **may impact individual northern bog lemming; however, it would not threaten their viability nor cause a trend towards federal listing**. The rationale for this determination includes (Kozlowski 2009):

- The species is known to reside within Maybee Meadows which is within the burn perimeter and has treatment units proposed in the vicinity.
- Treatment units are located well outside of the meadow which is preferred habitat for the lemming and outside of the riparian spruce corridor adjacent the meadow, additional habitat where bog lemming might occur.
- Harvest Units 23 and 25a are distinctly separated from bog lemming habitat by an existing open road. Mesic forested habitat associated with Maybee Meadows that might support occasional use by bog lemmings is well outside of the harvest units.
- Harvest Unit 24 is located predominately in the upland. Harvest operations would remain outside primary habitat consisting of riparian areas with boggy meadows, sedges, and grasses as well as the spruce riparian corridor. Harvest, yarding, hauling and all heavy equipment activities would be restricted to the southeast side of closed road

reconstruction in order to avoid impacts adjacent to Maybee Meadows. Northern bog lemming habitat would not be lost or reduced by harvest activities.

- Aquatic standards are in place in the Forest Plan that protect northern bog lemming habitat from cumulative effects that degrade water quality and riparian function.

Townsend's Big-eared Bat

Effects Analysis

There would be no direct, indirect or cumulative effects caused by the implementation of the proposed action alternative because it would not affect mines or caves; structures that serve as winter hibernation habitat and summer nursery colonies. Aquatic standards are in place to protect riparian habitats as potential foraging areas. Snags and old growth forest as potential roost areas are not a limiting factors and would remain widely distributed across the landscape.

Determination

The proposed action alternative would have no impact. Mines or caves would not be affected. Suitable habitat for foraging and roosting would remain abundant and widely distributed.

Spotted Bat

Effects Analysis

Direct and Indirect Effects

The main threats to the persistence of spotted bat populations are summarized in Luce and Keinath (2007):

- Habitat alteration: This species is vulnerable to loss or reduction in value of wet meadows and other foraging areas, at least at a local scale. Such impacts could result from over-grazing by livestock, water diversion, or changes in land use such as conversion of native habitats to tilled cropland. Loss or reduction of wetlands would not occur due to the proposed action alternative. Aquatic conservation standards are in place to protect riparian habitats as potential foraging areas.
- Roost loss and modification: Roosts consist of large isolated cliffs with rocky crevices. Although these features exist across the Forest, none are located near treatment areas. No such habitat would be affected by proposed activities. Similarly, no mines or caves would be closed or affected.
- Habitat management: Foraging habitat must be managed to maintain adequate insect populations. Spotted bat foraging habitat can include forest openings and subalpine mountain meadows in spruce, pine, and pinyon-juniper woodlands, large riverine/riparian areas, riparian habitat associated with small to mid-sized streams in narrow canyons, wetlands, meadows, and old agricultural fields. Riparian areas across the landscape would remain in their current condition. Snags, old growth forest, and other vegetative conditions would remain widely distributed across the treatment area as well as the landscape. As a result, foraging habitat and insect availability would not be affected by the proposed action alternative.

Cumulative Effects

Any past and reasonably foreseeable mine shaft closures were/will be evaluated for bat presence and/or habitat suitability through the Abandoned Mine Program. Appropriate measures to reduce

mortality risks as well as conserve potential bat habitat have been and will continue to be instituted. Recreation access is expected to increase by 10 to 20 percent over the next 15 years. To the extent that recreational rock climbing increases, there may be localized impacts to potential roosting habitat in other areas of the forest. Aquatic standards in the Forest Plan will ensure that all projects comply with maintaining good water quality and proper functioning riparian conditions, important to protecting bat foraging habitats.

Determination

The proposed action alternative would have no impact on spotted bats (Kozlowski 2009). The rationale for this determination includes:

- Mines, caves, or cliff habitat necessary for roosting would not be affected.
- Aquatic standards are in place to protect riparian habitats for foraging. Similarly, snags and old growth forest will remain widely distributed across the landscape
- The project would not contribute negative cumulative effects to the species or its limiting habitats.

Compliance with the Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

The proposed action alternative is consistent with Forest Plan direction for sensitive wildlife species. The following information sources were considered during the design of the proposed action: Management Plan and Conservation Strategies for Sage Grouse in Montana, Northern Region Conservation Assessment for Northern Goshawk, Black-backed Woodpecker, Flammulated Owl, and Pileated Woodpecker; Montana Comprehensive Wildlife Conservation Strategies; Grizzly Bear Conservation for the Greater Yellowstone Area National Forests (GYA); Montana Bald Eagle Management Plan.

Issue Driven Wildlife Analysis

Elk Security

Introduction

The Forest Plan states goals and objectives related to elk security including managing open road density at 1.2 miles per square mile (for the Big Hole Landscape), and 1.1 miles per square mile (in the fall) for hunt unit 321 (Hunt unit 321 includes the Big Hole Landscape and the Rat Creek Burn) (USDA Forest Service 2009b, p. 45-47).

Analysis completed in the FEIS for the Forest Plan Revision indicates that the Big Hole Landscape has an open road density of 1.2 miles per square mile (USDA Forest Service 2009b). Similarly, the FEIS indicates that fall open road densities within hunt unit 321 are at 1.1 miles per square mile. Thus, both the landscape and the hunt unit meet Forest Plan objectives for elk security. The smaller area proposed for salvage harvest has an existing open road density higher than those stated above; however this is not a concern as the management emphasis for elk security is intended to be applied at the landscape scale (Big Hole Landscape) and the Hunt Unit scale (Hunt Unit 321), to allow for multiple use goals across landscapes and management areas.

Effects Analysis

The proposed action alternative includes the construction of approximately 7 miles of temporary roads to access harvest units. These temporary roads would be rehabilitated and obliterated

following harvest. Three miles of closed system roads would be opened and reconditioned to access harvest units. After harvest, these roads would again be closed (by gate or other barrier) and rehabilitated in order to minimize erosion and discourage unauthorized vehicle use. The project proposal includes the design feature "Motorized use of temporary roads and National Forest System roads opened (previously closed) for harvest access will be restricted to motorized travel required for timber harvest operations and Forest Service administrative use. These roads will not be open to public motorized use in order to maintain open motorized trail and road densities at desired levels listed in the Forest Plan."

The following diagram shows the location of security habitat for hunt unit 321, and an expanded view of the proposed temporary roads and reconstructed roads for the project. The proposed road construction (temporary or re-construction) would not increase access to unroaded areas that provide elk security habitat.

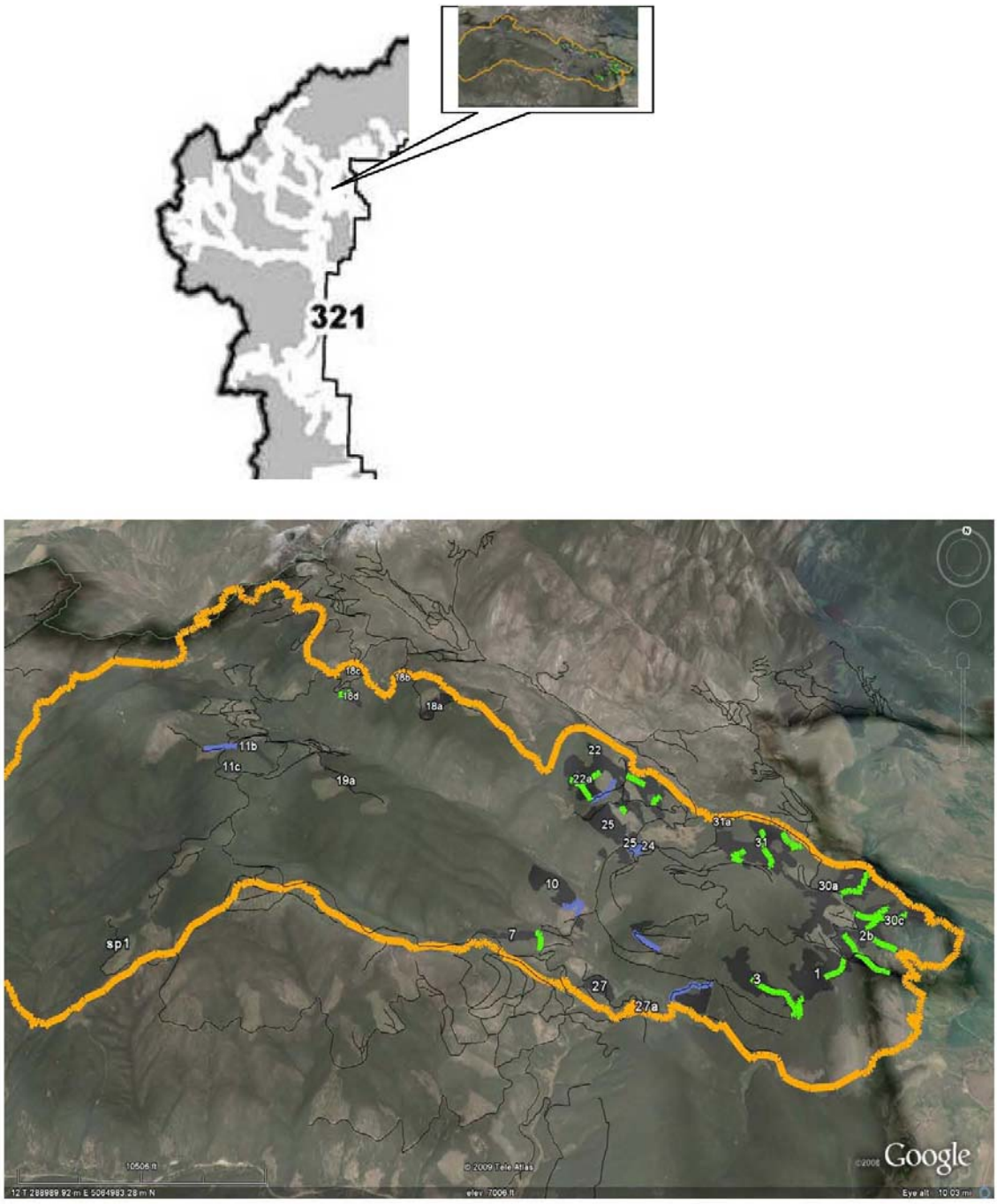

Figure 2. Rat Creek burn perimeter showing existing roads (in black) and proposed road improvements (temporary (green)/reconstruction (blue).

Road improvements will only be open to administrative use and harvest activities, then will be closed and/or obliterated after use.

Effects to elk security would be limited to temporary disturbances from motorized equipment and harvest activities in areas that are already moderately roaded. Changes to public access would not occur since use is limited to harvest and administrative activities. Overall elk security habitat would not be reduced, and will be consistent with Forest Plan goals and objectives. Hunting season open road density would meet Forest Plan goals for hunting unit 321, and Big Hole Landscape open motorized road/trail densities would be met during the project and after.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

Alternative 2 is in compliance with the Forest Plan and other relevant laws, regulations and policies.

- The project is within the Big Hole Landscape and Hunting Unit 321. The Big Hole Landscape is meeting the Forest Plan desired summer open motorized road and trail density and Hunting Unit 321 is meeting the desired fall open motorized road and trail density. The proposed action alternative would not increase the open motorized road or trail density.
- The proposed action alternative includes project design criteria to maintain snags at levels consistent with the Forest Plan standard for snags.
- The proposed action alternative does not include regeneration harvest.
- The project is outside the Primary Conservation Area Boundary for grizzly bear (USDA Forest Service, 2009b, Appendix G) and outside the boundary for the grizzly bear (Yellowstone Distinct Population Segment) (Kozlowski 2009).
- Northern Rockies Lynx Management Direction was considered in project design. Tracking of lynx habitat addresses a Conservation Recommendation in the US Fish and Wildlife Service Biological Opinion for the Northern Rockies Lynx Amendment (2007). The Beaverhead-Deerlodge National Forest is classified as unoccupied by lynx. The Forest has mapped Lynx Analysis Units (LAUs) and lynx habitat as part of the Lynx Conservation Assessment and Strategy (2000). Subalpine fir and spruce habitat types are the preferred habitat for the lynx in this part of their range. The proposed action would treat 8 acres of spruce-fir forest in LAU 207, 7 acres in LAU 221 and 2 acres in LAU 231, which is less than 1 percent of the subalpine fir and spruce habitat type in each LAU. Additional information regarding project level Canada lynx analysis can be found in the *Rat Creek Salvage Sale Biological Assessment/Biological Evaluation/Wildlife Specialist Report* (Kozlowski 2009) located in the project file. The proposed action alternative would have no effect on Canada lynx for the following reasons:
    - The proposed action would occur in unoccupied habitat as defined in the Northern Rockies Lynx Amendment (2007) and the Canada Lynx Conservation Agreement (2006), and US Fish and Wildlife Service species lists issued January 2009.
    - Linkage zones developed under the direction of the lynx steering committee provide potential pathways where the lynx could cross Montana State Highways 43 and 278 in the Big Hole Valley. The proposed action does not remove cover adjacent to these highways or create new barriers to travel. Riparian area protection requirements would facilitate movement of lynx through areas in the vicinity of vegetation treatments. The proposed action would not affect lynx linkage zones.

  - Only a small portion of the LAUs within the Rat Creek burn perimeter are dominated by spruce-fir forest, the preferred habitat for Canada lynx. Less than 1 percent of the spruce-fir habitat would be treated in the proposed action and the treated habitat is dead or dying as a result of fire or forest insects. The proposed action would not result in conditions that modify overall suitability of the LAU and/or landscape to support Canada lynx should the area become occupied in the future.
- The proposed action would occur in areas of forest vegetation and would not affect sagebrush steppe habitat that is important to sage grouse.
- The proposed action alternative is consistent with the Forest Plan standard for mitigating effects to goshawk and great gray owl nests because:
  - Burned forest areas no longer function as suitable nesting habitat. Known nesting sites were in areas that burned.
  - Proposed harvest units are located outside of riparian conservation areas where unburned forest stands may continue to function as nesting habitat.
  - Project design includes measures to protect nesting goshawks and their habitat.
  - The proposed action alternative is consistent with Forest Plan standards that maintain habitat for great gray owls, including: no harvest of old growth stands, retention of trees and snags greater than 20 inches DBH, and retains large diameter snag densities at levels similar to those found in unmanaged areas.
  - Habitat for northern goshawk and great gray owls remains widely available on the Forest.
- Project design includes the retention of large woody debris consistent with the Forest Plan standard for large woody debris.

Fish and Aquatic Habitat

This section discloses effects the Rat Creek Salvage Timber Sale is expected to have on trout and amphibians. These biological groups contain the aquatic species most frequently mentioned in public comments for land management proposals on the Beaverhead-Deerlodge National Forest. This analysis will address effects on populations that result from effects on aquatic habitat and effects on individual animals.

Issues were identified from concerns regarding impacts the proposed action may have on the abundance and distribution of species people wish to sustain on the Forest. Since the proposed action would occur outside existing water bodies and riparian areas, the most common effects are indirect and may result in changes to the abundance and quality of habitat for desired aquatic species.

There are no lakes within the analysis area; therefore all fisheries habitat is confined to streams. Amphibians are present in streams, ponds, wetlands and their riparian areas, so all of these represent habitats that could be affected. Amphibians are semi-aquatic and some spend portions of the year in upland terrestrial habitats; for this reason, it is possible that modification of upland terrestrial habitat could be detrimental. There is also some potential for direct mortality to individual amphibians from harvest and hauling activities. Finally, direction in the Forest Plan requires that we analyze the potential for new projects to increase the risk of aquatic nuisance species introduction. Aquatic nuisance species introduction would result in mortality and/or displacement of individual trout and or amphibians.

The proposed project has harvest units in portions of three 6th level sub-watersheds in the Big Hole River Drainage. This analysis will focus on streams in portions of these sub-watersheds that have some potential to be influenced by the proposed action. Their names and reference numbers follow:

- TrailLow (100200040407)
  - Sheep Creek
- Tie (100200040601)
  - Tie Creek (plus 1 un-named tributary)
  - Salix Creek
  - South Fork Tie Creek
  - Beaver Creek
- Johnson-Bighole (100200040602)
  - Johnson Creek

Bender and Schultz Creeks are in the Johnson-Big Hole sub-watershed; however, they are upstream of any harvest units and are not subject to influence by this proposed action. As such, they will not be considered within this analysis. Table 7 below lists game fish and amphibian species present within the analysis area by stream.

Table 7. Game fish and amphibian species present within the Rat Creek analysis area, by stream

Stream Name	Game Fish Species Present	Amphibian Species present
Sheep Creek	Brook Trout Burbot	Tailed Frog Spotted Frog
Tie Creek	Brook Trout Burbot	Western Toad Spotted Frog
SF Tie Creek	Brook Trout	
Beaver Creek	Brook Trout	Tailed Frog
Salix Creek	Unsurveyed	
Johnson Creek	Brook Trout Burbot	Tailed Frog

Spatial and Temporal Context for Effects Analysis

From a temporal perspective, this analysis considers negative effects to populations that persist beyond one year, as potentially significant. When populations with relatively short generation cycles (2-5 years) experience negative effects beyond this timeframe there is reasonable potential for that population to experience declines for at least a generation. Should this happen, the significance of the effect could be substantial, but will depend on whether the population is healthy and robust or small and/or declining.

The spatial context for direct and indirect effects consists of aquatic habitats in three 6th field HUCs, in the West Big Hole drainage, where the land management actions from this proposed action will occur. They are the Trail-Low, Tie, and Johnson-BigHole HUCs. Perennial streams in

these HUCs are listed above. Small ponds and wetlands are present within these HUCs, but are un-named.

The "relevant scale" for evaluating effects is typically less than the entire body of water a population occupies. For a fishery it may be a stream segment (for example - where spawning or over-wintering occurs). For an amphibian population, it may be a single shoreline with vegetative characteristics used for breeding, or which, for some other reason, attracts and concentrates adults or juveniles.

Past timber harvest, road and trail construction and maintenance, and livestock management represent activities relevant to the cumulative effects analysis and were considered. Although wildfire is not considered an activity in the strict sense of the term, it warrants consideration for cumulative effects.

Alternative 1 - No Action

Direct and Indirect Effects on Habitat

The effects of Alternative 1 are considered relative to current, existing conditions. Existing conditions of aquatic habitats within the analysis area generally result from fire and post-fire related effects. Changes in the timing of, and/or increases in the magnitude of stream flows are likely because of recent wildfires. Increased erosion and sediment delivery have already occurred and will continue to occur. Wildfire has also changed vegetation characteristics of riparian areas and uplands.

The Rat Creek Salvage Hydrology Report (Salo 2008) describes the effects of the Rat Creek and Mussigbrod fires on changes in stream flow regimes. It states: *"Because recent wildfires have drastically reduced overstory canopy on both watersheds it is very likely that changes in streamflow regimes may ultimately affect stream channel function/stability. This expected response to the loss of overstory canopy would require monitoring of channels to determine the magnitude and distribution of changes in stream channel function/stability. It may take several years for the effects related to the loss of over-story canopy to manifest itself."*

Wildfire impacts on habitat in affected stream reaches range from moderate to high. They are of the intensity and scope to impact fisheries, amphibians and reduce populations for one or more generations.

Burton (2000) reported that habitat and trout densities declined dramatically following uncharacteristically large and intense wildfires on the Boise National Forest, but typically rebounded strongly within 5 years. Post fire floods also rejuvenated habitats by delivering nutrients, transporting and redistributing sediments, and recruiting large amounts of woody debris and rock. Higher fish densities than were present before the fire were documented.

Within the Rat Creek project area it is doubtful extinctions of existing fish and amphibian populations have or will result from the effects of the fire because of its burn pattern, which left suitable islands of refuge, and because the distributions of populations extend beyond the fire effects boundary. Open corridors currently remain, providing opportunities for individuals to migrate to and supplement populations in the project area. As impacts from the fire recede in coming years, the carrying capacity of aquatic habitats will increase, allowing for higher levels of recruitment.

Post-fire effects experienced by amphibian populations are generally less than those experienced by fish for four reasons: (1) their semi-aquatic/terrestrial life history allows them greater latitude to search for and find suitable habitats; (2) with the possible exception of tailed frogs, their biological requirements tend to make them less sensitive to sediment related impacts; (3) an increase in the occurrence and seasonal duration of standing water bodies and wetlands will likely result from the substantial reduction in forest over-story; and (4) shrubs and other low-lying vegetation should become prolific in most areas of the burn over the next few years, likely increasing terrestrial cover types preferred by many amphibians.

Based on the findings of Burton (2000) and existing conditions within the project area, post fire nutrient inputs and rejuvenation of the channel formation process should improve degraded aquatic habitat conditions over the next few years. Full recovery of the fishery (possibly with greater densities than were present before the fire) seems likely within 5-8 years.

Current habitat conditions and post-fire related dynamics of recovery are part of the existing conditions. No harvest or road building is proposed in Alternative 1, hence there would be no increase in erosion and sediment delivery over existing conditions. There would be no change in the vegetative character of riparian areas or uplands. Alternative 1 would result in no change from existing conditions.

Table 8. Habitat Indicators and Determination; Alternative 1

Habitat Indicator	Determination (change from existing condition)
Changes in the timing and/or increases in the magnitude of stream-flows	No
Increased erosion and sediment delivery	No
Changes in vegetative characteristics of riparian areas	No
Changes in vegetative characteristics of upland areas	No

Table 9. Magnitude of Impacts on Aquatic Habitat; Alternative 1

Category for Assessing Magnitude of Impacts on Habitat	Determination (existing condition)
Intensity	No impact
Scope	No impact

Direct and Indirect Effects on Individual Animals

Vehicle related mortality to amphibians from harvest and hauling activities

No harvest and no hauling would occur in Alternative 1. Thus, there would be no increase in traffic within the analysis area and no increase in vehicle related mortality to amphibians.

Table 10. Vehicle Mortality and Western Toad; Alternative 1

Vehicle Mortality Indicator	Determination (change from existing condition)
Documented annual frequencies of vehicle related amphibian mortality within project area	No documented vehicle related mortalities
Proximity of roads to known breeding sites in or near-to the project area	No known breeding sites within analysis area
Estimated increases in traffic from this alternative during periods of migrational movements	No increase in traffic over current levels

Mortality and/or displacement of individual trout or amphibians resulting from the introduction of aquatic nuisance species (ANS)

There are no timber harvest activities proposed in Alternative 1, so there is no potential for ANS introduction.

Table 11. Aquatic Nuisance Species and Determination of Effects; No Action Alternative

ANS Indicator	Determination (change from existing condition)
Are aquatic nuisance species currently present within the project area and will the proposed activities likely increase the rate of spread within the project area	No
Will the proposed project increase access to previously remote water bodies with low recreational use levels.	No
Will the proposed project promote substantial increases in recreational use on water bodies within the project area	No
What are the types of recreational uses promoted; and are they the types of things that can lead to intended or inadvertent introductions	Not Applicable

No timber harvest activities would occur with the selection of Alternative 1. The intensity and scope of impacts to individual animals would not change from the current conditions and remains at negligible levels.

Table 12. Magnitude of Impacts on Individual Animals and Determination of Effects; No Action Alternative

Category for Assessing Magnitude of Impacts on Individual Animals	Determination (change from existing condition)
Intensity	No impact
Scope	No impact

Cumulative Effects

For Alternative 1 (no action) no harvest or road building is proposed, hence effects to habitat or to individual animals would not occur. As such, there are no cumulative effects to be considered.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

For Alternative 1 (no action) no harvest or road building is proposed, hence there can be no lack of compliance with the Forest Plan or other relevant laws, regulations or policies.

Summary of Effects

For Alternative 1, because no action would occur, there is no change from existing conditions. Thus, there is no effect on aquatic populations.

Alternative 2 - Proposed Action

This analysis recognizes all design features and mitigation measures developed by the Soil Scientist and discussed in the Soils report. Design features include buffering all units a minimum of 300 feet from perennial streams, and 150 feet from intermittent streams. Soil design features can be found on EA pages 12-13.

Direct and Indirect Effects on Aquatic Habitat

Harvest should not result in any appreciable decrease in forested canopy cover because this is a salvage project, trees to be harvested have lost their foliage or foliage loss is imminent, and there would be no change the existing hydrograph.

The *Rat Creek Salvage Hydrology Report* (Salo 2008) indicates that predicted sediment travel distance of eroded soil generated on a harvest unit is far less than the distance to the stream. The difference under the worse-case scenario of 246 feet can be considered a margin of safety. Even under a worse-case scenario, the potential for any sediment delivery from a harvest unit is extremely low.

Within that same report, the Cross-Drain application (WEPP) indicated sediment delivery to streams is unlikely, and no sediment is expected from temporary roads (USDA Forest Service 2008c). Only isolated segments of existing roads lie within a 160 foot buffer. WEPP Road was used to determine if a change in use levels (high traffic versus low traffic) would result in a change in sediment leaving the buffer. The model indicated there should be no sediment delivery based on increased use of the roads.

There are no activities in RCAs, so there would be no changes in vegetative characteristics of these areas.

Harvest is planned in upland areas; however, it would do little to change the Forest canopy in ways that influence amphibian movement. For those trees that would be harvested, the canopy has already been removed. As such, the amount of solar radiation reaching the floor, ground level cover, and the relative humidity at ground level (characteristics important to amphibians), would change little due to activities proposed in alternative 2.

Table 13. Habitat Indicators and Determination; Alternative 2

Habitat Indicator	Determination (change from existing condition)
Changes in the timing and/or increases in the magnitude of stream-flows	No
Increased erosion and sediment delivery	No
Changes in vegetative characteristics of riparian areas	No
Changes in vegetative characteristics of upland areas	Minimal

Changes in the indicators are predicted to be minimal; for this reason, the intensity of impacts on habitat is negligible. The scope of harvest is moderate for the project area; however, the impacts (i.e. change) relative to quantity and quality of habitat for aquatic species is minimal. Thus, the scope of impact is small.

Table 14. Magnitude of Impacts on Aquatic Habitat; Alternative 2

Category for Assessing Magnitude of Impacts on Habitat	Determination (change from existing condition)
Intensity	low
Scope	small

Direct and Indirect Effects on Individual Animals

Vehicle related mortality to amphibians from harvest and hauling activities

The greatest risk of high vehicle related mortality occurs when a road is immediately adjacent to a breeding area (a focal point of concentration from which dispersal of individuals occurs), traffic rates and vehicle speeds are high and coincide with the timing of adult and/or juvenile dispersal, and/or a road separates a breeding site from other desirable habitat, .

Given the elevation of National Forest System land in the analysis area, and life history of various native amphibians, concern for mortality is greatest for the western toad, a Region 1 sensitive species that can migrate greater distances overland than other native amphibians that tend to be aquatic obligates (Bartelt 2000).

Schmetterling and Young (2008) found that western toad migrational movements tended to be more common during the night or during rainstorms. This, presumably, is due to toads needing favorable ground level humidity to meet their physiological requirements. Humidity levels are higher during the night and after rainstorms when the soil is saturated.

Assuming logging activity and hauling would occur in a typical summer-fall season, July through November, and would continue over 3 years, the increase in traffic from logging trucks necessary to haul the volume of timber estimated to be salvaged in Rat Creek is approximately 20 trucks per day. This amounts to about 2 trucks per hour within a 10 hour work day. Nearly all of the hauling is likely to occur in daylight hours between sunrise and sunset.

Existing forest roads in and around the project area are gravel surfaced and exhibit vehicle use at relatively low intensities (an estimated average of about 40 vehicles per day) and low speeds. There are currently about 3 miles of road within RCAs. The majority consists of 600 to 800 foot segments at stream crossings (assumes a 300 ft RCA on each side of perennial streams).

Temporary road construction and road reconditioning would occur under this alternative; however, no roads or stream crossings would be built within the RCA. None of the locations slated for temporary road construction are near sites where amphibians have been observed and documented. The temporary road accessing units 9 and 10 is the closest new road in proximity to a stream, pond or wetland with documented use by amphibians. A corner of this road would come within 300 to 350 feet of Tie Creek. The majority of the road's length angles away from the stream, with about 500 feet of road remaining within 500 feet of the stream. All other roads are substantially further from streams.

Western toads were observed in Tie Creek from 2000 to 2001 within a mile of a segment of temporary road that would be constructed. This is the only location in the project area where toads have been observed, and no subsequent observations of toads have occurred. However, they are assumed to be present.

Forest employees were asked to watch for amphibian road-kills over the last four field seasons; however this does not represent a formal survey. Few occurrences of amphibian road kill were documented across the Forest, suggesting it is relatively uncommon. The possibility of toads being struck by vehicles on a Forest road is presumed; however, this information suggests road related mortality on the Forest and project area is absent to very low.

There are no known breeding sites near existing or planned roads. The estimated increase in daytime traffic from logging trucks is relatively insubstantial at 2 vehicles per hour, and this traffic should not coincide with night-time hours when toads are more likely to migrate. Vehicle related mortality to amphibians should not significantly change from existing levels.

Table 15. Vehicle Mortality and Western Toad; Alternative 2

Vehicle Mortality Indicator	Determination (change from existing condition)
Documented annual frequencies of vehicle related amphibian mortality within project area	No documented vehicle related mortalities within the project area
Proximity of roads to known breeding sites in or near-to the project area	Not proximal. There are no known breeding sites within project area
Estimated increases in traffic from this alternative during periods of migrational movements	There will be little increase in the amount of truck traffic during night-time hours and when amphibians would tend to migrate

Mortality and/or displacement of individual trout or amphibians resulting from the introduction of aquatic nuisance species (ANS)

The nearest occurrence is whirling disease, in the Big Hole River, approximately 8 miles from the eastern edge of the Tie 6th field HUC. The activities associated with road building and timber harvest do not require interaction between infected sites in the Big Hole and the project area. Project related actions would not increase access to previously remote water bodies, and should not promote substantial increases in recreational use on water bodies there. For Alternative 2, there is no likely increase in the risk of ANS introduction.

Table 16. Aquatic Nuisance Species and Determination of Effects; Alternative 2

ANS Indicator	Determination (change from existing condition)
Are aquatic nuisance species currently present within the project area and will the proposed activities likely increase the rate of spread within the project area	No
Will the proposed project increase access to previously remote water bodies with low recreational use levels.	No
Will the proposed project promote substantial increases in recreational use on water bodies within the project area	No
What are the types of recreational uses promoted; and are they the types of things that can lead to intended or inadvertent introductions	Not Applicable

Table 17. Magnitude of Impacts on Individual Animals and Determination of Effects; Alternative 2

Category for Assessing Magnitude of Impacts on Individual Animals	Determination (change from existing condition)
Intensity	Absent to low
Scope	Absent to very small

Under Alternative 2 the intensity and scope of impacts to individual animals does not substantially change from current conditions and remains at negligible levels.

Cumulative Effects

Because this alternative results in negligible effects on aquatic habitat and individual aquatic animals, the cumulative effects are also considered negligible.

Summary of Effects

The proposed action alternative would have no measurable negative effect on aquatic habitat or aquatic populations.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

Alternative 2 is in compliance with the Forest Plan and other relevant laws, regulations and policies. A table of all aquatic standards in the Forest Plan along with a description of compliance can be found in the *Rat Creek Salvage Aquatic Species Report* (Brammer 2009) in the project file.

Soils

Introduction

To predict the overall effects of project implementation to the soil resource, the amount of detrimental disturbance by each harvest unit was projected. The Disturbed WEPP model (USDA Forest Service 2008c) was also run to generate predicted erosion as a result of the Rat Creek fire and proposed salvage harvest. Landtypes with the highest risk of erosion hazard were used. Details of the modeling assumptions can be found in the project file, Soil Resource Report (Fletcher 2008).

Spatial and Temporal Context for Effects Analysis

The spatial context for the discussion of direct, indirect, and cumulative effects of the proposed action are the harvest units, including landings and temporary roads associated with the proposed units. With few exceptions, soil cumulative effects occur only when management activities occur on the same site. Large mass failure and debris flows, or large sediment deposits from off-site disturbances are exceptions where off-site impacts affect soils in another location. Previous management has occurred in various locations throughout the project area; however, no detrimental soil disturbance was observed at plots taken in the field. Analyzing effects to soil at a landscape scale (e.g. by watershed) is unreliable, since it does not involve analyzing soil disturbance as it is assessed under the Northern Region Soil Quality Standards (USDA Forest Service 1999), which is a site-specific, activity area approach.

The Northern Region Soil Quality Standards (USDA Forest Service 1999) address the National Forest Management Act (NFMA) ensuring that soils will not be irreversibly damaged. Since Soil Quality Standards must be met by the close of the project, soil productivity will have been maintained over the short-term. Additionally, soil recovery would occur in the years following

implementation, as vegetation reestablishes. For example, Dumroese and others (2006a), in comparing detrimental soil disturbance after post-fire salvage logging, found less detrimental disturbance (4 percent) at a location that had a few years to recover before monitoring, versus 28 percent detrimental disturbance for a site that was monitored 1 year after the project was completed, and cited vegetative recovery as a reason for the difference between the locations. Soils will not recover at the same rate, however, and recovery will be largely dependent on the type of disturbance and the inherent characteristics of the soil in question. Dumroese and others (2006b) found that after five years, the surface 10cm of severely compacted coarse-textured soils experienced some recovery; however, fine-textured soils showed little recovery in the same timeframe. Similarly, after 16 years, a loamy soil showed no improvement in detrimental compaction found in skid trails (Rawinski and Dumroese 2008).

To assess the potential longer-term effects of post-fire salvage logging on soil quality, a 7.5-acre unit less than a mile from Homestake Pass that burned in 1988 and was logged in 1989 was assessed in October, 2008. The unit currently meets stocking levels with lodgepole pine. Thirty-four plots were taken across the unit and no detrimental disturbance was found. Soils in the unit are poorly developed sandy loams. The average litter depth was 1.58cm; the average litter depth of a nearby unburned control was 2.5cm. Live plants were present in 94 percent of the plots, and fine woody debris was also found at 94 percent of the plots. Bare mineral soil was present at 14.7 percent of the plots; but was not detrimental. It was determined that 73.5 percent of the plots had some sort of biological soil crust present (e.g. moss and/or lichen species). Usually the crust was present along with grasses or other plants. Common and important in arid environments, biological soil crusts can take years to recolonize a site after fire (DeBano et al. 1998). The site appears to have mostly recovered since the fire and subsequent harvest.

Given these results on similar-textured soils in the project area and the effectiveness of mitigation measures (see below for further discussion), it is likely that the soil will have recovered to a large degree within 20 years of project implementation.

Alternative 1 - No Action

Direct Effects

Under the no action alternative, no direct effects to the soil resource would occur. Natural processes would continue.

Indirect Effects

Under the no action alternative, as the trees in the project area fall, they create more fuels on the ground, which increases the potential for soil heating if the area reburns. One measure of high fire severity is soil temperature. Soil organic matter is destructively distilled (Hosking 1938) between 200 and 300 degrees Celsius and these temperatures are predicted to occur to a soil depth of 1cm at a fuel loading of about 40 tons/acre (Brown and others 2003, p.5). A wildfire occurred in the vicinity of the project area in 1985, burning approximately 1,200 acres near Gibbons Pass. Some of the areas were salvage logged so that large fuel loads are less than 20 tons per acre. Other areas were not salvage logged and now have an average 75 tons per acre in the unsalvaged portions of the burn 17 years after the fire, with scattered snags still standing (USDA Forest Service 2003). Given a 75 ton per acre fuel loading, Brown and others (2003, p.5) predict that destructive soil temperatures (200-300^{o} Celsius) would occur to a soil depth of at least 3cm and possibly 5cm. The area burned severely is dependent on coarse woody debris diameter, but would likely be at least 25 percent assuming a 9-inch diameter. They predict (p. 9) that the timeframe for a high severity burn would occur between 30 and 60 years from now, due to the redevelopment of a

forest floor and fine fuels to carry the fire, which typically are not present immediately post-fire. Surface data collected in summer 2008 indicate that a forest floor and fine fuels *are* currently present in the project area to a certain degree since fully 25 percent of data plots taken within proposed harvest units are unburned, and a further 41 percent of the plots are classified as low severity burned, which entails a charred or unburned duff layer. Based on this local information, it is possible that the period of greatest risk for a high severity burn due to heavy loads of coarse woody debris would begin as the trees begin to fall, about 10 years from now. Brown and others (2003) predict that after about 60 years, the decay of the coarse woody debris is projected to reduce risk of severe burning. For the Beaverhead-Deerlodge NF, the cold and dry climate is not conducive for decay (Arno 1976); therefore, it is likely that the greatest risk of high severity burn extends beyond 60 years.

Cumulative Effects

Potential cumulative effects of the no action alternative include the effects of soil heating from the Rat Creek fire in addition to the increased potential for soil heating if the area reburns in the future. Effects of soil heating would be variable across the landscape, dependent on the site-specific fuel load. Severe soil heating is of the greatest concern, since the temperatures are great enough to change soil physical and biological attributes (USDA Forest Service 1999). Assuming 75 ton per acre fuel loading, at least 25 percent of the area would be affected by soil heating should the area reburn. Cumulative effects would be expected to be similar to the direct and indirect effects of the no action alternative, since the Rat Creek fire was predominantly a low severity fire, and very localized areas of severe soil heating occurred.

Alternative 2 - Proposed Action

Design Features and Mitigation Measures

The proposed action includes project design features and mitigation measures to protect soils (EA pages 12-13). Soil and water conservation practices (SWCPs) are per USDA Forest Service 1988, and are referenced below where appropriate. Direction for implementing SWCPs is set forth in the Region 1 Soil Quality Standards: *"Design and implement management practices that maintain or improve soil quality. Protection of the soil resource should be emphasized; restoration practices should be implemented where necessary" (USDA Forest Service 1999).*

Direct Effects

Expected detrimental disturbance for each proposed harvest unit was projected as described in the methodology section above and results are displayed in Table 18.

Table 18. Projected detrimental soil disturbance for harvest units and temporary roads

Unit	Unit Size (acres)	Landing Area (acres)	Temporary Road Area (acres)	Percentage of Unit Detrimentally Disturbed
1	116.19	0.24	1.1	12.55
2a	131.09	0.48	0	11.77
2b	178.05	0.88	2.15	13.10
3	70.31	0.24	1.0	13.17
4	26.16	0.24	0	12.32
4a	7.05	0.08	0	12.54

Unit	Unit Size (acres)	Landing Area (acres)	Temporary Road Area (acres)	Percentage of Unit Detrimentally Disturbed
7	44.99	0.24	0.31	12.62
9	4.43	0.08	0	13.21
10	60.32	0.16	0	11.67
11a	14.39	0.16	0	12.52
11b	28.85	0.16	0	11.96
11c	8.24	0.08	0	12.38
18a	38.63	0.16	0	11.82
18b	3.15	0.08	0	13.95
18c	18.37	0.08	0	11.84
18d	19.96	0.08	00.26	13.91
19a	10.05	0.16	0	13.00
19b	5.24	0.08	0	12.93
22	13.91	0.08	0	11.98
22a	84.70	0.48	1.14	13.32
23	171.03	1.21	0.9	12.63
23a	5.82	0.08	0	12.78
24	14.54	0.16	0	12.51
25	82.41	0.40	0	11.89
25a	3.46	0.08	0	13.72
26a	15.94	0.16	0	12.41
26b	4.30	0.08	0	13.27
27	37.21	0.16	0	11.83
27a	8.16	0.08	0	12.38
30a	129.54	0.32	1.20	12.57
30b	20.33	0.08	0.84	15.93
30c	4.11	0.08	0.20	18.27
31	318.71	0.64	2.42	12.36
31a	12.06	0.08	0	12.07
Sp1	6.74	0.08	0	12.59
AVERAGE PROJECTED DETRIMENTAL DISTURBANCE				**12.85**

Two of the proposed units, 30b and 30c, are expected to exceed the Region 1 Soil Quality Standards of no more than 15 percent of an activity unit in detrimental condition. Detrimental soil disturbance on a percentage basis due to temporary road construction is expected to be 4.13 percent for unit 30b and 4.91 percent for unit 30c. Therefore these two units are expected to return to under 15 percent detrimental disturbance after the temporary roads associated with the units are obliterated, since obliteration is a form of restoration (USDA Forest Service 1999). Each unit was projected to have 11.4 percent detrimental disturbance from designated skid trails. See Table 18 for projected detrimental disturbance by unit. Detrimental soil disturbance associated with burning slash piles is included within the landing acres in Table 18, since the slash piles will be burned on landings.

The average projected detrimental disturbance is 12.85 percent. These predicted results are comparable to observed levels of detrimental soil disturbance post-activity. Dumroese and others (2006) found an average of 16 percent detrimental disturbance on post-fire salvage logging using tractor equipment in the summer. Local forest monitoring has shown that tractor yarding on dry soils typically results in less than 10 percent detrimental soil disturbance (USDA Forest Service, 2007c). After project implementation, any harvest units that do not meet standards will be rehabilitated to ensure that 85 percent of the harvest unit is in satisfactory condition; this will assure that productivity effects are reduced in the near term and eliminated over the long term.

Indirect Effects

Ground disturbing activities associated with the proposed action have the potential to expose mineral soil to overland flow and subsequent erosion. Potential erosion as a result of project implementation was modeled using Disturbed WEPP and the assumptions listed above in the methodology section. Our assumption of sustained 30 percent slopes represents the worst-case scenario for the project area. Typically, steep areas such as this are limited in area and occurrence. The 99 percent cover represents the existing post-fire condition. Table 19 demonstrates that the probability of erosion in the first year following the disturbance increases from 30 percent to 34 percent for loam soils, and is unchanged for sandy loam soils. Sandy loam soils have greater infiltration rates, and are less susceptible to erosion. In any given year, there is a 20 percent chance that the erosion rate would be equal to or greater than the five-year rate.

The accuracy of all Disturbed WEPP predictions is, at best, plus or minus 50 percent (Elliot et al. 2000). The Region 1 Soil Quality Standards state that the tolerable soil loss rate is generally less than 1 to 2 tons per acre per year (USDA Forest Service 1999).

The proposed action is not modeled to increase the erosion risk at all in sandy loam textured soils, and is only modeled to increase the risk to a small degree in loamy soils. Essentially, the amount of ground cover present in the project area will minimize erosion. Addressing burned area rehabilitation, Robichaud et al. (2000, p. 48) cite 30 percent cover reduces erosion by half and 60 percent cover reduces erosion rates to insignificant levels. Our projected cover of 86 percent for the proposed action is thus above the levels considered adequate in terms of cover and erosion control.

An 86 percent cover also does not take into account SWCPs listed above in the mitigation measure section. These SWCPs will ameliorate disturbance associated with harvest, reduce erosion potential, and hasten soil recovery. Locally, SWCPs have been shown to be effective in minimizing soil disturbance; specifically for tractor yarding on dry ground, detrimental disturbance typically has been found to be less than 10 percent (USDA Forest Service 2007c). This is well under the Regional Soil Quality Standard of 15 percent (USDA Forest Service 1999).

Leaving dead and downed wood on the site also moderates impacts from logging activities. The temperature and moisture modifications of downed wood on the forest floor create zones for increased soil biological activity with greater mycorrhizal fungal activity and concentrated bacterial populations (Graham et al. 1994, Perry and Amaranthus 1997, p. 44).

Table 19. Disturbed WEPP results

Soil Type	Cover (percent)[1]	Probability of Erosion in First Year Following Disturbance	Five-year Erosion Rate (tons/acre)[2]
Loam	99%	30%	0.63
Loam	86%	34%	0.79
Sandy Loam	99%	2%	0
Sandy Loam	86%	2%	0

[1]The 99 percent value represents the existing condition (no action alternative) and the 86 percent value represents the expected cover with implementation of the proposed action.
[2]In any given year, there is a 20% chance that the erosion rate will be equal to or greater than the five year rate.

Cumulative Effects

The cumulative impact from the proposed harvest activities in addition to recent wildfire would not likely lead to long-term impairment of soil productivity. Fire burn severity was classified as low as indicated from soil surface assessments done in the majority of proposed treatment units (Fletcher 2008). No existing detrimental disturbance was noted in the proposed harvest units. Amaranthus and Trappe (1993) observed reduced infiltration and flow interception as result of severe wildfire. However, because of the low burn severity of the Rat Creek fire, less than 1 percent bare soil, similar infiltration rates between burned and unburned sites, and because the ground will have had two years for disturbance recovery, infiltration and flow interception should be close to normal. Cumulative impacts may be greatest where ground vegetation and ground cover is disturbed. These influences are discussed in detail in the section entitled Direct and Indirect Effects.

Cumulative effects from grazing are unlikely as no existing detrimental effects were found within proposed harvest units. Any grazing effects within the units that may occur would generally be limited to cattle trails and comprise a small amount of disturbance. Cumulative effects due to recreation would be limited to areas where proposed harvest units are also dispersed camping sites. No such sites were noted within the proposed harvest units; recreation sites are mainly concentrated along the South and Main Forks of Tie Creek along Road 1203, and do not coincide with proposed harvest units. Obliteration of temporary roads would prevent unauthorized motorized access and any associated effects.

Within the project area, the Rat Creek Roadside hazard removal project is expected to be implemented in the foreseeable future. None of these harvest units overlap with the proposed action units. Since cumulative effects to soils occur only when management activities occur on the same site, no cumulative effects are expected as a result of this activity.

Compliance with the Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

The proposed action, if implemented, would meet the standards to protect soil productivity set forth in the Region 1 Soil Quality Standards (USDA Forest Service 1999) and referenced in the Beaverhead-Deerlodge Forest Plan (USDA Forest Service 2008b). No slopes greater than 35 percent would be harvested that have not had a site-specific analysis showing that damage is unlikely.

No significant effect to the soil resources is expected to occur because:

- The Rat Creek fire resulted in a low-severity burn to the soils, with 99 percent ground cover and live plants present throughout the proposed harvest units.
- Slopes greater than 35 percent are avoided (unless a site specific analysis has determined damage is unlikely) as directed by the forest plan.
- The proposed action is predicted to result in an acceptable level of detrimental soil disturbance (as required by the Region 1 Soil Quality Standards and the Forest Plan) after temporary roads are obliterated. After project implementation, any harvest units that do not meet standards will be rehabilitated to ensure that 85 percent of the harvest unit is in satisfactory condition; this will assure that adverse productivity effects are reduced in the near-term and eliminated over the long-term.
- Project design incorporates soil mitigation measures that have been shown to be effective.

Water Resources

Introduction

Potential adverse effects from the Rat Creek Salvage timber sale that might occur to water quality, stream flow regimes and stream channel function are disclosed in this section. Changes to water quality or stream flow regimes is considered under direct and indirect effects, while change to stream channel function or stability is disclosed under cumulative effects. The extent of the area considered for cumulative effects is the 6th field Hydrologic Unit Code (HUC) truncated at the Forest boundary. This area was selected because any effects derived within the forest boundary can be masked due to effects from activities on private lands. Two truncated 6th field watersheds are included in this area: Tie Creek (19,624 acres) and Johnson Creek (14,696 acres).

Proposed activities that could potentially affect water resources include timber harvest and yarding, and temporary road construction. Potential effects include direct, indirect and cumulative. Each alternative has been analyzed for the effects of associated treatments in addition to past, present and reasonably foreseeable future actions. The action alternative considers the salvage of dead vegetation due to wildfire. Changes in channel stability expressed in terms of functioning status, represent the ultimate analysis of cumulative effects, and relate to changes in sediment and/or inputs of water. Potential channel responses to increased flow include increased channel width and meander length, increased sediment supply due to bank instability, and downcutting (Metzler 1992). Potential channel responses to increased sediment inputs are increased width, decreased depth, decreased sinuosity, and increased meander length and radius of curvature. Channel type plays an important role in determining the sensitivity to changes in stream channel stability resulting from changes in flow and sediment (Rosgen 1996).

Sediment introduced directly into a stream channel, such as during construction of a stream crossing, constitutes a direct effect. Tractor yarding across a stream would constitute a direct effect if sediment were introduced at the time of the action. Indirect effects include changes to the sediment and/or water supplied to a stream system. This is especially true where roads are hydrologically connected to stream channels. Road construction that results in sediment at some later time is one example.

Additional information regarding water resources, the methodology used in analysis, or project conditions can be found in the *Rat Creek Salvage Hydrology Report* (Salo 2008) located in the project file.

Timber Harvest

Streamflow

Removal of live timber can potentially affect the timing and magnitude of streamflows, usually on third order or smaller basins. Studies on larger order watersheds do not show appreciable increases, either from timber harvest or fire (Troendle and Bevenger 1998). Research on small basins (less than 3 square miles) indicates a measurable increase when more than 20 percent of the cover is removed (Stednick 1996). Consideration should be given to the relationship between flow and sediment. Increased sediment is often due to channel scour from longer duration of peak flows resulting from vegetation removal (Troendle and Olsen 1994; Troendle and Bevenger 1998). Changes in timing and magnitude of snowmelt rates and peak flows are most affected by mature tree removal on mid-slope positions, with a 1 percent annual water yield increase for each 4 to 5 percent of cover removed (Farnes et. al. 2000).

Sediment

Timber harvest can increase onsite soil loss and sedimentation. The yarding system applied during harvest plays a large role in determining soil disturbance. A study in the granitic batholiths in Idaho (Megahan et. al. 1995) found that helicopter yarding caused the least soil disturbance of all logging systems, with an average total area of disturbance of 4 percent. Other systems reviewed included skyline (9.1 percent), ground cable (23.9 percent), and tractor (33.5 percent). The soil disturbance in the study does not equate to disturbance levels developed in the Region 1 Soil Quality Standards. It does provide a relative comparison between different yarding systems. The quantity of sediment produced is determined to a large degree by the care taken by the operator (Rice et. al. 1979). This emphasizes the importance of good sale administration.

Road Construction and Maintenance

Roads make up the primary source of sediment delivery to streams from logging activities in the western United States rather than timber management activities (Ketcheson G.L.; Megahan W.F. 1996; Rice et al. 1979,). About 70 percent of sediment delivery occurs the first year after road construction (Ketcheson G.L.; Megahan W.F. 1996). A literature review found that sediment transport in non-channelized flow rarely travels more than 300 feet (Belt, O'Laughlin, and Merrill 1992). Reducing sediment delivery to streams is accomplished two ways: (1) reduce the volume of erosion through on-site erosion control practices; or (2) Reduce sediment delivery by increasing retention on hillsides (Burroughs and King 1989).

To determine any potential changes in sediment delivery, ground disturbing activities were evaluated for soil erosion or displacement through model analysis using the Water Erosion Prediction Project or WEPP (Elliot 2004; Elliot and Foltz. 2001; Elliot and Hall 1997) and site visits of units and proposed temporary roads (see Soils section). Where soil erosion or displacement has been predicted through modeling or inherent with an activity (landings or temporary roads), delivery of sediment to a perennial stream system will be accomplished using prediction equations (Ketcheson and Megahan 1996) for harvest units, and WEPP Cross Drain model for temporary roads.

The prediction equations show that sediment travel distance is directly proportional to sediment volume and inversely proportional to obstructions on the hillside. The length of obstructions was developed with the project Soil Scientist using soil plot information and accounting for the desired large woody debris loading. The length of obstructions derived from desired large woody debris loading (tons/acre) was accomplished using the General Technical Report – 190 (Keane

and Dickinson 2007). Three different equations were developed for sediment produced from fills, rock drains and culverts which represent discrete sources of sediment. The equation developed for fills was used in this analysis, and an assumption was made that sediment delivery mechanisms are the same regardless of the source. The difference worth noting is that soil movement associated with harvest units typically occurs in a much more dispersed fashion than that derived from roads. This means that sediment delivery results using the prediction equations likely overestimate sediment travel distance due to the dispersed nature of the sediment volume derived from harvest units.

Sediment delivery from temporary road construction was estimated using WEPP Cross Drain. This model computes the erosion produced from a designated road segment, and then predicts what portion of that sediment will reach a stream by accounting for variables including distance and slope of buffer between the road and stream; road width, road gradient and cross drain spacing. The variables used in the analysis represent a site with the most potential for delivering sediment within the project area.

WEPP Road was used to determine if change in use levels (high traffic versus low traffic) would result in change in sediment delivery from existing roads that lie 160 feet from a stream. The assumption is that current levels of use constitute a low use level, and logging truck traffic would constitute a high use level.

Field reconnaissance of units as well as existing and proposed roads provides useful information for validation of model results. Site specific review of proposed actions allows identification of any design or mitigation features needed to meet the desired condition.

Spatial and Temporal Context for Effects Analysis

Short-term effects are associated with sediment delivery. Any potential sediment delivery from timber harvest typically diminishes very quickly, approaching pre-disturbance rates within 3 years. Potential sediment delivery from landscapes disturbed by fire may take longer to recover, depending on soil types and burn severity (Elliot and Robichaud 2001; Spigel and Robichaud 2007). The potential for sediment delivery from road construction is highest the first year of construction, and then subsides to a base rate after 10 years. Changes in streamflow regimes due to cover removal (harvest, insect/disease, or fire) can last 80-90 years in lodgepole stands in Montana (Farnes et al. 2000). Because changes in streamflow regimes can affect stream channel function/stability, the timeframe for assessing cumulative effects can extend beyond the 80-90 years. The analysis area used for cumulative effects must represent a watershed area large enough to support a beneficial use like aquatic life support; though not so large that effects which drive stream channel function/stability changes become masked or diluted.

Connected Actions, Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

Past timber harvest, road and trail construction and maintenance, and livestock management represent activities relevant to this cumulative effects analysis. Although wildfire is not considered an activity in the strict sense of the term, it represents another important effect for cumulative effects.

Alternative 1 – No Action

Direct Effects

No stream crossings are planned so there would not be activities in close proximity to streams; therefore no direct effects.

Indirect Effects

No harvest or road building is proposed, hence there would be no indirect effects. The Soils report describes the risk for a high severity "re-burn" that begins about 10 years from now, and continues for about 60 years. This risk is not quantified. Soil-water function can be defined as the ability of the soil mantle to infiltrate, store and release moisture. The associated risk to soil-water function is reduced infiltration, which may result in increased soil erosion if a "re-burn" event occurred. For sediment delivery to occur under this hypothetical scenario, a storm event of a high magnitude would need to occur soon after a high severity "re-burn" event. This entire scenario requires a succession of "what-ifs" that makes predicting a reduction in sediment delivery by implementing a salvage operation very difficult to achieve in a quantified fashion.

Cumulative Effects

Recent wildfires have drastically reduced overstory canopy on both watersheds; therefore, it is very likely that changes in streamflow regimes may ultimately affect stream channel function or stability. Monitoring of channels would be required to determine the magnitude and distribution of changes. It may take several years for the effects related to the loss of overstory canopy to manifest itself. For example, if the loss of overstory canopy is followed by several years of below-normal precipitation, then increases in streamflow regimes may not be realized until normal precipitation patterns return. Recovery related to reductions in levels of substrate fines might be slowed or reversed due to the watershed scale effects of wildfire. This alternative creates a relatively increased risk of long-term erosion and possible sediment delivery if a "re-burn" event should occur. While possible, it is highly speculative that the magnitude of any sediment delivery would cause a shift in substrate composition and affect stream channel function or stability.

Summary of Effects

No sediment delivery is predicted for Tie Creek or Johnson Creek. No change in percent vegetation cover is predicted.

Compliance with the Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

This alternative would be consistent with Forest Plan water resource standards, Clean Water Act and State Water Quality standards which support an A-1 classification. This alternative meets the direction and load allocations listed in the Draft version of the Upper Big Hole Total Maximum Daily Loads (TMDL). A long-term consequence of not harvesting would create a condition to exist that increases the risk of a re-burn event with possible high burn severity. This might lead to a subsequent higher risk of erosion and sedimentation. Predicting long-term fire risks and post-fire consequences in absolute terms is not possible; therefore, ascertaining consistency within the regulatory framework can only be done in relative terms as described under cumulative effects.

Alternative 2 – Proposed Action

Design Features and Mitigation Measures

This analysis recognizes all design features and mitigation measures. Design features include buffering all units a minimum of 300 feet from perennial streams, and 150 feet from intermittent streams. While all temporary roads would be located far from streams, the following guideline is recommended for spacing water bars or other appropriate drainage on temporary roads:

- Cross drain spacing at a minimum should be determined by dividing 1000 (feet) by the percent grade of the road. For example, a road segment with a 5 percent grade should have a minimum cross drain spacing of 200 feet.

Direct Effects

No stream crossings or other disturbances are planned within stream channels. No direct effects.

Indirect Effects

The Soils report describes the WEPP model runs, with assumptions and site conditions used. The worse-case situation produced 1.8 cubic meters sediment leaving the profile of a one-acre plot from a 50-year return period storm. It is important to note that this sediment volume is on-site, not delivered to a stream system. This volume of sediment was used in the sediment delivery prediction equation. The second variable required in the prediction equation is the length of obstructions encountered perpendicular to the fall line of the slope. The lengths used were 7 and 14 meters. Table 20 displays the results.

Table 20. WEPP model predicted sediment volume and travel distance

Sediment Volume (cubic meters) using WEPP	Length of Obstructions (meters)	Predicted Sediment Travel Distance	Minimum Distance to perennial stream (Unit 4)
1.8	7	56 feet	300 feet
1.8	14	44 feet	300 feet

The analysis discussed in this section shows that predicted sediment travel distance of eroded soil generated on a harvest unit is far less than the distance to the stream. The difference under the worse-case scenario of 246 feet can be considered a margin of safety. Even under a worse-case scenario, the potential for any sediment delivery from a harvest unit is extremely low.

The Cross-Drain application (WEPP) was used to predict potential sediment delivery to a stream from temporary roads. The model inputs used include a silt loam soil type, buffer length of 160 feet, buffer gradient of 10 percent, a road width of 12 feet and a road gradient of 8 percent (maximum expected). The results are shown in

Table 21

Table 21. Potential sediment delivery to streams from temporary roads (based on WEPP Cross-Drain)

Cross drain spacing (feet)	Average annual sediment yield (pounds)
30	0
100	0
200	0
400	0
800	167

The analysis also shows that sediment delivery is predicted only when using extreme distances between cross drains. Using the mitigation listed above, the recommended cross drain spacing for a road segment with 8 percent grade is 125 feet. By implementing this mitigation under the scenario of input variables used for Cross Drain, no sediment is expected from temporary roads. Also worth noting is that the actual buffer length for all temporary roads is far greater than 160 feet. This greatly reduces the potential for any sediment delivery.

Only isolated segments of existing roads lie within a 160 foot buffer. These roads are currently well maintained with all applicable Best Management Practices (BMPs) in place. A severe convectional storm event hit the project area during July, 2008. Forest Road (FR) 1203 was examined near the bridge on Tie Creek after the storm and appeared hardest hit by the storm. It was observed that the existing belt style water bars were very effective at dispersing runoff. While sediment deposits were noted in the buffer zone between the road and the stream, no sediment delivery to Tie Creek was noted. WEPP Road was used to determine if a change in use levels (high traffic versus low traffic) would result in a change in sediment leaving the buffer. The model inputs include a silt loam soil texture, outsloped rutted road design, graveled surface, road gradient 6 percent, road length (distance between cross drains) 180 feet, width 14 feet, fill gradient 30 percent, fill length 10 feet, buffer gradient 20 percent, and buffer length 160 feet. This approximates the conditions found at the FR 1203 near Tie Creek. The results were that both use levels (high and low) predicted zero sediment leaving the buffer.

Cumulative Effects

Cumulative effects are similar to those described under the No-Action alternative, with a slight variation in long-term effects with respect to salvage harvest. No difference in canopy coverage is expected from salvage harvest of dead and dying trees (Farnes et al. 2000; Love 1955). Salvage harvest may decrease the risk of a future re-burn event on treated units, which could reduce the possibility of high burn severity effects (See Soils section). This might reduce the risk of erosion and sediment delivery (Elliot and Robichaud 2001). Predicting long-term fire risks and post-fire consequences is done in relative terms. Sediment delivery mechanisms are not well established with the treatment units; therefore, it is difficult to predict that reduction in sediment delivery would occur, preventing a shift in substrate composition and maintaining stream channel function and stability.

Summary of Effects

No sediment delivery is predicted for Tie Creek or Johnson Creek. No change in percent vegetation cover is predicted.

Compliance with the Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

This alternative would be consistent with Forest Plan water resource standards, Clean Water Act and State Water Quality standards which support an A-1 classification. This alternative meets the direction and load allocations listed in the Draft version of the Upper Big Hole TMDL. Salvage harvest may reduce the risk of a re-burn event with possible high burn severity. This might lead to a subsequent lower risk of erosion and sedimentation. Predicting long-term fire risks and post-fire consequences in absolute terms is not possible; therefore, ascertaining consistency within the regulatory framework can only be done in relative terms as described under cumulative effects.

Fire and Fuels

Introduction

The fire and fuels project area are the units proposed for treatment in Alternative 2. The area considered for cumulative effects includes past actions within approximately 0.5 miles of the project boundary.

Future fuel loading was predicted by modeling data obtained during walk-through surveys. Estimates of surface fuels were made using Fuels Management Analyst (FMA). Fire behavior characteristics and hazard were derived by assigning nationally accepted fire fuel model groups (Scott and Bergen 2005). A wildfire similar to the Rat Creek fire occurred near Gibbon's Pass, just west of the Rat Creek fire in 1985, burning approximately 1,200 acres. Portions of this fire were salvaged logged and portions remain untreated. This area was used to validate fuel modeling for this project.

Historic weather data was obtained for fire behavior modeling. The 90th percentile weather was chosen for fire behavior modeling. That is, weather parameters such as fuel moisture, wind speed and dry bulb temperature represent the "average worst" conditions that can be expected on 90 percent of all days that fires occur. More severe weather conditions would likely result in more severe fire behavior and fire effects. Additional information regarding project area fuel conditions, fuel models and assumptions can be found in the *Rat Creek Fire and Fuels Report* located in the project file (Lewis 2009).

Alternative 1 - No Action

Under the No Action Alternative, no activities would occur and no silvicultural or fuels reduction treatments would be implemented.

Direct and Indirect Effects

Under this alternative fuel would continue to accumulate in the form of dead material from trees killed by the fire, insect and disease mortality, and limbs, boles, and needles adding to the fuels that have accumulated since the last burn cycle. In as little as 15-20 years it is estimated that most of the snags will have fallen to the ground, substantially increasing surface fuel loadings.

Vegetation mixed with heavy logs and slash would diminish the firefighter's ability to construct and hold fireline. Hand fireline construction is significantly slowed where firelines intersect numerous large logs; firelines have to be relocated, slowing fireline construction. This delay at the critical initial attack phase of a new fire could result in larger, more severe wildfires, decreasing the probability of successful suppression. Studies indicate that small woody debris (3 inches and less in diameter) can contribute to increased spread rate, intensity of surface fire,

torching and crowning while large woody fuels (generally greater than 3 inches in diameter) can reduce large fire growth and high fire severity (Brown et al. 2003). Table 22 displays fireline intensity and flame length as it relates to suppression difficulty (Rothermel 1983).

Table 22. Fireline intensity interpretations

Intensity	Flame length (feet)	BTU/feet/second	Interpretations
Low	<4	<100	Direct attack at head and flanks with hand crews, handlines should stop spread of fire
Low–Moderate	4–8	100–500	Employment of engines, dozers, and aircraft needed for direct attack, too intense for persons with hand tools
Moderate	8–11	500–1,000	Control problems, torching, crowning, spotting; control efforts at the head are likely ineffective
High	>11	>1,000	Control problems, torching, crowning, spotting; control efforts at the head are ineffective

Fuel Loading

Under No Action, an accelerated amount of dead fuels would be added to the forest floor over time, with about 90 percent of dead trees expected to fall down within 20 years.

Table 23 shows the average dead and down woody fuel loadings predicted by FMA in 2030.

Table 23. No Action Alternative fuel loading (tons per acre) and wildfire resistance to control

Stand Type	2008			2030		
	<3 in.	>=3 in.	Resistance to control Rating	<3 in.	>=3 in.	Resistance to control Rating
Lodgepole Pine	2	6	Low	6-12	25-40	High
Notes: <3 in. and >=3 in. are dead woody fuels						

Resistance to control would generally be considered high in most stands by the year 2030. This means that surface and ladder fuels would accumulate in the absence of fire or treatment. Fires that escape initial attack, which are usually those burning under severe conditions, are more likely to become large and damaging. Pockets of dead standing snags would remain, increasing the risk to firefighters and contributing to long range spotting.

As vegetation fills in the gaps left by fire killed trees, ladder fuels would be created. These ladder fuels would consist of the relatively low lying branches of regenerating trees and shrub species. Such fuels would be highly vulnerable to the higher flame lengths and more severe fire effects from high fuel loading. Modeled fire behavior for the no-action alternative in the year 2030 is displayed in Table 24.

Table 24. Fire behavior potential and hazard for Alternative 1 in year 2030

Fuel loading	Fuel Model*	Flame Length (feet)	Fire Rate of Spread (chains per hour)	Canopy Base Height needed to prevent torching (feet)
Moderate	SB01	5	14	9
Moderate to High	SB02	9	36	19

*SB01 represents activity fuel or debris from wind damage, fine fuel load is 10-20 tons per acre, weighted toward fuels 1-3 inches, depth is less than 1 foot. SB02 represents activity fuel or debris from wind damage, blowdown is scattered with many trees still standing (Scott and Bergen 2005).

Cumulative Effects

No cumulative beneficial effects would occur with the selection of this alternative. This action would not respond to the National Fire Plan Goals of reducing hazardous fuels, and ensuring public and firefighter safety.

Alternative 2 - Proposed Action

Direct and Indirect Effects

Under this alternative the future high surface fuel loading would be reduced due to the removal of fuels created by fire and insect mortality. Treatments would remove or modify the future surface fuels as well as the activity generated fuels and decrease the amount of material needed to be removed during fireline construction, allowing for suppression personnel to use direct attack tactics as described in Table 22.

Activity fuels resulting from salvage harvest would be lopped and scattered or piled and burned at the landing site. Excess fuels would be piled and burned resulting in a reduced fire hazard. Immediately following salvage operations, fuels would be higher than under the no action alternative, resulting in short term effects. This would increase the fire hazard of the area for a short period of time, (2-4 years) but after that, the effects of vegetative growth and stem breakage would equal out the fire hazard.

Table 25 displays expected post treatment woody fuel loading. Fuel loading estimates are based on treatment proposals including lop and scatter and/or piling and burning. Resistance to control would be reduced over the no action alternative, thereby reducing the risk of a fire escaping initial attack in the future. Fires would also tend to have less severe effects due to lower amounts of heavy fuels, which tend to burn for a long time.

Table 25. Fuel loading post treatment

Stand Type Level	2008			2030		
	<3 in.	>=3 in.	Resistance to control Rating	<3 in.	>=3 in.	Resistance to Control Rating
Low	2	6	Low	4-8	10-20	Moderate
Notes: <3 in. and >=3 in. are dead woody fuels						

The most appropriate fuel treatment strategy is often thinning (removing ladder fuels and decreasing tree crown density) followed by prescribed fire, piling and burning of fuels, or other mechanical treatments that reduce surface fuel amounts. This approach reduces canopy, ladder, and surface fuels, thereby reducing both the intensity and severity of potential wildfires (Graham et al. 2004). Because only trees that are dead or dying would be removed under this alternative, there would be very minimal if any reduction in canopy fuels. However, ladder and surface fuels would be reduced. Most of the effects would be to the surface fuels that would accumulate after the dead trees begin to fall.

Table 26. Fire behavior potential and hazard for the proposed action in year 2030

Fuel loading level	Fuel Model	Flame Length (feet)	Fire Rate of Spread (chains[6] per hour)	Canopy Base Height needed to prevent torching (feet)
Low	TL 04	2	6	5
Low to Moderate	TL 05	3	10	5

Fire modeling indicates that the reduced fuel loading will decrease the likelihood of torching and spotting fire behavior as compared with the existing condition. Table 26 displays the changes in fire behavior calculated for the fuel models anticipated under alternative 2 in the year 2030. Rate of spread and flame length are both predicted to be lower than under the no action alternative (see Table 24). The Canopy base height needed to be able to resist torching is lower; therefore both natural and planted trees are much more likely to survive when a fire occurs. Because the fire is less intense, the likelihood of a successful initial attack is increased.

The proposed treatment activities are expected to reduce fire behavior characteristics resulting in improved fire fighter safety as compared with the No Action alternative. Piling and burning would further reduce fuels, resulting in even less potential fire behavior than with chip on site (mastication) actions.

Cumulative Effects

The accumulated dead fuels and vegetation in the project area are partially a result of historic fire suppression in the vicinity. Several large fires have occurred within the project area in the last 10 years. These fires reduced fine fuels in the short term, but in some cases also increased the amount of large diameter fuels in isolated areas. The existing condition of the project area is the result of the past fire suppression activity and the management actions such as grazing and logging.

The Sheep Creek Project reduced fuels in the vicinity and is expected to lower the flammability in that area. The expected reduction of potential fire behavior in the Sheep Creek Project would compliment the treatments designed to reduce fuels under the proposed action.

Fire suppression in the project area is likely to continue for the foreseeable future. Fire suppression has the potential to both compliment and contrast with the proposed fuel treatments. Suppression can inhibit the ability of natural fire to reduce fuels by limiting the total burned area. On the other hand, active fire suppression combined with the reduced fuel hazard has a better chance of reducing the harmful effects of uncharacteristic fire.

[6] 1 chain equals 66 feet

There would be no cumulative effect to the fuels hazard from ongoing and reasonably foreseeable activities, such as road maintenance, weed control, or public use of national forest lands. Roadside hazard tree hazard removal in the Rat Creek fire area will reduce the potential future fuel loading along roads which could serve as fire control locations.

Compliance with the Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

This alternative would be consistent with The Beaverhead-Deerlodge Forest Plan goals and objectives for fire management. Proposed activities are expected to reduce fire behavior characteristics resulting in improved fire fighter safety as compared with the No Action alternative. The proposed action is also consistent with the National Fire Plan (USDI and USDA 2000; USDI and USDA 2001), Federal Wildland Fire Policy (USDA et al. 1995), and Healthy Forest Restoration Act (2003).

Air Quality

Introduction

The smoke from fire contains a number of pollutants, including tiny particles called "particulate matter" (PM). Exposure to PM can cause significant health problems, especially for people suffering from respiratory illnesses. Smoke also adversely affects the clarity of the air, or visibility. Based on recent health research, Environmental Protection Agency (EPA) revised the air quality standards to provide improved health and visibility protection. With the new standards in place, land managers must consider using techniques that minimize prescribed fire emissions and the adverse impacts of smoke on public health and the environment. Careful planning and cooperation among land managers, air quality regulators, and local communities ensures that prescribed fire, clean air and public health goals can be met.

The project area lies within Montana/Idaho Airshed 7 which includes Beaverhead County. Airsheds are defined and managed by Montana Department of Environmental Quality (MDEQ). The Montana/Idaho Airshed Group (Airshed Group) as authorized by the Montana Department of Environmental Quality (MDEQ) implements the Smoke Management Program in Montana and Idaho by making recommendations as to whether or not a burn can occur, given forecasted meteorological conditions, burn type, burn location and other surrounding proposed burns. The burner uses the recommendations of the Airshed Group, "Best Available Control Technology (BACT)" and site specific conditions to determine whether to burn on a particular day or not.

Existing emission sources in the project area include vehicles, road dust, residential wood burning, wood fires, and smoke from forest fires. Emissions are limited with no local visible sources of impairment. The entire project area is considered to be in attainment (meeting the standards for emissions) by the MDEQ. Air quality in Airshed 7 and the Rat Creek Fire area is considered good to excellent during most of the year. Occasional short-term adverse effects occur naturally from wildfire. Air quality and visibility can deteriorate due to temporary air stagnation during these events, which are most common during the months of July, August, and September. Smoke from private debris burning, agricultural burning, and wood burning stoves all contribute smoke to Airshed 7.

Communities that do not meet or "attain" air quality standards over a period of time are designated by the EPA as non-attainment areas. The nearest PM-10 non-attainment area is Butte Montana, located approximately 55 air miles northeast, located in airshed 6.

The only Mandatory Class I area near the Rat Creek Fire Area is the Anaconda-Pintler Wilderness. The Wilderness is roughly 158,000 acres in size and is located 2 miles north of the project area.

The extent of the area considered for cumulative effects in regard to air quality is the surrounding Montana/Idaho Airshed 7. This airshed includes all of Beaverhead and Madison Counties plus the southern portion of Jefferson County. This area was selected because this is the air unit monitored by the MDEQ for air quality and primary wind direction (north and northwest) that would be blowing during burning operations. Foreseeable activities that overlap the timeframe of the proposed project were considered in the analysis.

Alternative 1 – No Action

Direct and Indirect Effects

No prescribed burning would occur under Alternative 1. Fuels from fire-killed trees would fall over time and remain on site until natural decomposition takes place or another wildfire occurs in the project area. Impacts from dust, vehicle emissions, and other sources would not change from current conditions.

This alternative would have no immediate direct adverse effects on air quality. If a wildfire were to occur, the potential indirect effects include degraded air quality and reduced visibility. Existing and continued mortality and fuel accumulations would contribute to increased fire intensities and severities. Consumption of the increased fuel loads and understory biomass would increase the amount of smoke emissions. In fact, emissions from wildfire are typically twice those of a prescribed fire on the same acreage due to greater emission factor (Ottmar 2001), fuel consumption, and fire intensity. These emissions would also occur over a period of a few days to several weeks as opposed to intermittent days over several years for a prescribed fire project.

Cumulative Effects

There would be no cumulative effects to air quality caused by management activities under Alternative 1 since no new burning activities would be proposed and effects to air quality are usually episodic and of short duration. A large wildfire in the area cannot be predicted so it would not be reasonably foreseeable. Fire suppression will continue to occur under both alternatives..

If a wildfire occurred, there is a potential for the National Ambient Air Quality Standards to be exceeded depending on the size and duration of the wildfire. If a large wildfire were to occur, the Forest Service and the State of Montana Air Quality Bureau could, depending on the specific situation, restrict all regulated burning. However, effects of smoke from a large wildfire could become cumulative with present and foreseeable activities or combined with unregulated pollutants in the area, such as dust from roads.

Alternative 2–Proposed Action

Under this alternative, two categories of activities may contribute to air quality impacts if implemented. Both categories of activities would result in temporary, transient impacts to local, and possibly regional, air quality. The first involves dust from ground disturbances that may be associated with salvage, and removal activities. The second activity is from prescribed pile burning. The only burning proposed under this Alternative is the burning of residual piled slash at landings and scattered, piled concentrations.

Burning of landings and piles would occur during late fall or early winter[7] after a unit has been salvaged. Pile burning (particularly landing pile burning) typically occurs after an area has received significant rain or snow to prevent the pile from spreading and reduce the risk of escape. Burning would occur over the life cycle of the project estimated at 3-4 years and as units are completed. Mitigations would include limiting the number of piles ignited per day to assure air quality standards are met; and halting all pile burning if, through cumulative effects of other contributors, air quality standards are expected to be exceeded.

The main air quality concern associated with this project is the quantity, concentration and duration of PM 2.5 produced by proposed prescribed pile burning. Up to 70 percent of smoke particulate is PM 2.5 or smaller. Particulate matter is comprised of a mixture of solid particles and liquid droplets. Particle size is measured in microns (one micron equals one millionth of a meter). Particles can be up to 50 microns or larger. Fine particles, 2.5 microns and smaller (PM-2.5), are of the highest concern because the may be inhaled deep into the lungs and they pose a greater threat to public health and visibility. PM 2.5 are generally emitted from activities such as industrial and residential combustion, wildland fire, agricultural burning, and vehicle exhaust.

Direct and Indirect Effects

Alternative 2 would have a direct, short-term impact on air quality in the immediate project vicinity. Management activities under this alternative would likely cause direct short-term impacts from dust. Specifically these activities involve chipping, chewing and grinding of dead vegetation, loading and processing activities at landing sites and truck transportation of material. These activities are not anticipated to result in significant impacts to regional air quality because of the transitory nature of fugitive dust and because mitigation measures such as road watering would be applied during hauling activities.

Table 27 depicts the modeled maximum PM 2.5 concentrations emitted from prescribed pile burning in the project area. Results indicate the 24-hour maximum PM 2.5 value would be below the federal 35 µg/m3 threshold within 0.1 mile downwind of the project area. Modeling indicates the PM 2.5 concentrations drop off significantly after 0.1 mile and do not exceed the threshold in any case. Best Available Control Technologies (BACT) would be used by the burner when these units are burned to mitigate potential smoke impacts to the airshed as described above. Generally, impacts would be minimal and would be confined to the project area. Modeling shows there would be no significant impacts to any Class 1 airshed resulting from this project and impacts would be confined to the immediate project vicinity.

Table 27. Modeled pm 2.5 concentrations from proposed burning

Burn Type	Modeled Unit	Cover Type	Considerations	24-hr max PM 2.5 (µg/m3) 0.1 mi downwind from unit (with mitigations)
Landing Piles	100 piles	Lodge Pole Pine/Douglas Fir	Assume maximum ignition of 10 Landings per day	28
Machine Piles	30 piles	Lodge Pole Pine/Douglas Fir	Assume maximum ignition of 30 piles/day	28

[7] Special permission is needed from Montana DEQ if any burning is to occur between December 1 and March 1. This time period is not coordinated through the MT/ID Airshed Group.

The action alternatives could produce some smoky days in the local area. Some smoke would be expected to settle into the lower draws and drainages during the evening hours following ignition. The dominate winds, when burning is planned, are generally from the north and northwest; therefore some possibility of transitory smoke in those directions is expected. This may also result in the form of nuisance smoke, smell or haze under the worst-case scenario.

The prescribed burning smoke from this project may have the potential to affect Airshed 7 however the small size of the project treatment areas and burning under good smoke dispersion conditions should alleviate any adverse air quality effects.

Cumulative Effects

Cumulative effects on air quality of smoke from burning piles, produced as a result of the implementation of Alternative 2, would result in an incremental decrease in air quality as PM2.5 particles from this source combined with other particles produced both by the implementation of other aspects of this project, specifically fugitive road dust, as well as other local and regional sources located upwind. Prescribed burning of logging slash, on other federal, state or private lands, would also contribute particulates, as would agricultural burning and fugitive dust from tilled ground. Particulates from industrial and automotive sources also contribute to regional particulate loading. Other vehicle traffic and agricultural and industrial sources within the project area would also contribute to the cumulative particulate loading. It is not possible to predict the amount of particulates contributed by these other sources.

There may be days when regional air quality does not meet the established standards but, because of the Montana/Idaho Smoke Monitoring Units effectiveness at limiting the amount of burning in any given day, there is reduced likelihood that any source associated with this project or any other present or reasonably foreseeable future burning project, would be a significant contributor. If these safeguards failed, and air quality does not meet the established standards, mitigation measures call for the secession of all pile burning, so the duration of exceeding would be minimal. This would not be the case in a wildfire situation.

The cumulative effect on Class 1 Airsheds from the implementation of the proposed action and other present and reasonably foreseeable future actions is not known at this time. The production of air pollutants associated with the implementation of this project would vary over time and would not be continuous. Impacts would be intermittent in nature and the potential for occurrence would end when the implementation of this project is completed.

Compliance with the Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

Congress passed the Clean Air Act (CAA) in 1963, and amended it in 1970, 1977, and 1990. The purpose of the act is to protect and enhance air quality while ensuring the protection of public health and welfare. The 1970 amendments established National Ambient Air Quality Standards (NAAQS), which must be met by most state and federal agencies, including the Forest Service.

States are given the primary responsibility for air quality management. The Clean Air Act requires States to develop State Implementation Plans (SIP) that identify how the State will attain and maintain NAAQS. The Montana Clean Air Act promulgates the SIP and created the Montana Air Quality Bureau (now under the Montana Department of Environmental Quality (MDEQ)). The Clean Air Act also allows States, and some counties, to adopt unique permitting procedures and to

apply more stringent standards. MDEQ are advisors to the Idaho/Montana Airshed Group and regulate smoke emissions through a burn approval process and monitoring program. MTDEQ retains the authority to recommend go/no go decisions for burning in the fall. In the spring, this is done by the Airshed Group Smoke Coordinator. The Clean Air Act requires that Forest Service actions have "no adverse effect" on air resources by meeting the NAAQS and non-degradation standards for Class I Areas. Managers are further directed to improve substandard existing conditions and reverse negative trends where practicable (e.g. Missoula is a "non-attainment" zone in need of improvement). All Prescribed Fire Burn plans address mitigation measures to minimize smoke impacts and comply with the Clean Air Act. All prescribed burning would be implemented in full compliance with MDEQ air program with coordination through the Montana/Idaho Airshed Group. Alternative 2 would meet Forest Plan Standards for air quality by following coordination requirements.

The General Conformity Rule (1990 Clean Air Act Amendments; Section 176 C of the Clean Air Act) implements the Clean Air Act conformity provision, which mandates that the federal government not engage, support, or provide financial assistance for licensing or permitting, or approve any activity not conforming to an approved CAA implementation plan. This project conforms to the CAA.

Recreation

Introduction

The extent of the area considered for cumulative effects is the Tie-Johnson Management Area and the portion of the Trail Creek Management area that is north of State Highway 43 (USDA Forest Service 2009a). This area was considered because this is the extent of the area the effects of the proposed salvage harvest and related activities would impact those involved in recreation activities. Project effects would not likely impact those involved in recreation outside this area. The analysis considered on-going and foreseeable activities within this area.

Alternative 1 – No Action

Direct and Indirect Effects

Sport hunting for big game such as deer and elk is common in the Tie-Johnson Management area and no effect to this activity is expected under the no action alternative. Use of the road and trail system, and the recreational opportunities attributed to them (to include dispersed recreation) would not be affected.

Cumulative Effects

Because there would be no direct or indirect effects of the no action alternative on recreation activities, there would be no cumulative effects.

Alternative 2 – Proposed Action

Direct and Indirect Effects

The proposed actions would occur in the summer roaded and winter motorized recreation allocations.

Activities

Direct effects of the proposed action may limit places sought by hunters and others who participate in summer roaded and winter motorized recreation. These effects are expected to last for 2-3 years after the sale is sold and activity begins.

Project design features in the proposed action include road and trail closures to public use. These would be imposed where harvest operations create hazardous conditions for the general public. Restrictions on log hauling during weekends and federal holidays from September 6 through November 30 would minimize impacts to those involved in motorized recreation during fall hunting seasons.

People involved in hunting or pursuing other forms of dispersed recreation where or when the above restrictions do not apply may be subject to and/or experience indirect effects such as sounds and sights attributed to harvest activity such as timber falling, log hauling, noise, dust, and occasional road delays. The same short and long term time frames mentioned for the above apply here as well.

In the long term, the proposed action is expected to render more and better quality forest lands to recreational users as burned out acres are replaced over time with healthier stands, and no long-term direct or indirect effects are expected. All operations and use would return to normal upon completion of the harvest activities under the proposed action alternative.

Inventoried Roadless Areas

Activity would not occur where harvest is not suitable such as in Inventoried Roadless and Summer Non-motorized Areas. Inventoried Roadless Areas within the project area include Beaver Lake 1-003A and North Big Hole A1-001. No harvest activity is planned in areas that were evaluated for roadless consideration in the past (Beaver Lake 1-003B).

Recreational users in a small section of the Beaver Lake Roadless Area may experience sights and sounds created by harvest activity occurring outside the roadless area. By and large, the overwhelming majority of this roadless area would remain unaffected. Units Sp1, 11a, 11b, and 11c are situated from 500 feet to 0.5 miles from the east side of Beaver Lake Roadless Area boundary, and are adjacent to salvage units from where past activity occurred in the mid 1990s. The other proposed harvest units are from 1 to 7 miles away and would not affect roadless characteristics. The main access feature for the public to this roadless area is Forest Road 1210, where approximately 2,000 ft. of temporary road is planned. The land use designation adjacent to this east aspect of Beaver Lake Roadless area is Summer/Winter Motorized. Noise and sights associated with activity suitable for this area may be noticed by those who happen to be in this small, specific section of roadless when activity occurs, whether it be project related or not. However, the combined 56 acres of salvage proposed in this vicinity (3 percent of the total harvest area) is expected to be short in duration (4 to 8 weeks), and the primitive, semi-primitive non-motorized/motorized characteristics would be restored shortly.

All proposed units are located approximately 1 mile or more from the North Big Hole A1-001 Roadless Area; therefore, no potential for affects to roadless characteristics is expected.

Trails, Roads and Streams

Important recreation features of the Big Hole Landscape include sections of the Nez Perce National Historic Trail, Lewis and Clark National Historic Trail, and Continental Divide National Scenic Trail, and the entire Length of the May Creek National Recreation Trail. A large part of the

Anaconda Pintler Wilderness, with access along its southern boundary, is within the landscape setting as well.

No direct or indirect effects to these important features are expected due to the great expanse of distance, topographic relief, and vegetation masses that exists between them and any harvest activity (or not) under any alternative.

The main road of concern (due to high use and visibility from a tourist's perspective) is Montana Highway 43, which runs east to west along the bottom half of the Tie Johnson Management Area. Sale units 6 and 7 are the closest proposed units to this road and the distance is approximately 2.5 miles. This distance along with the terrain and vegetation between them, ensures that any activity in the project area would be unnoticed and the scenic character of the landscapes from this road would be unaffected by either the no action or proposed action alternatives.

Trails of concern or significance in the project vicinity include:

- Lewis and Clark National Historic Trail (running along the southwest corner of the management area)
- The Continental Divide National Scenic Trail (running along the northwest aspect of the management area)
- The May Creek National Recreation Trail (Starts at the south central edge of the Tie-Johnson, and continues in that direction away from the management area)

Unit 18d is the closest harvest unit to the Lewis and Clark National Historic Trail and it is approximately 2.6 miles away. Unit Sp1 is the closest harvest unit to both May Creek and the Continental Divide National Scenic Trails at approximately 2 miles distance. Since these trails are not in the vicinity of the harvest units and access to them does not involve traveling through the project area, the recreation experiences of hiking, camping, and sight seeing from them would not be effected by the proposed action.

A section of Forest Road 71204 runs along the south aspect of proposed Unit 4 where there is direct access to a section of Tie Creek. The public may find stream access at this location interrupted while activity at Unit 4 is occurring, but any interruption would be short term (i.e., the length of time it takes to harvest the unit). No other harvest units are in close proximity to the streams; therefore, recreation along streams will not be disrupted by harvest activities.

Recreation Sites

No developed recreation sites are featured in or around the project area so no affects are expected.

Cumulative Effects

Additional, ongoing and foreseeable activities that may disrupt or impact those involved in recreation include road-side hazard tree removal. These activities are similar to those described for this project and would be relatively short in duration; impacts would be limited to the road corridors. On-going and foreseeable projects would not add to the current road network, and the proposed action would not add to the current inventory of forest roads (used for road based recreation). The direct and indirect effects are expected to be limited in duration. Harvest activities are expected to be completed within 2 or 3 years; therefore, no cumulative effects to forest recreation are expected.

Compliance with the Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

The Proposed Action and No Action Alternatives would meet the goals, objectives, and standards outlined in the 2009 Beaverhead-Deerlodge National Forest Revised Land Management Plan. No road construction is proposed in summer non-motorized allocations. Public use of area roads would be restricted to those designated routes identified in the Forest Plan (USDA Forest Service 2009a, p. 55).Timber harvest is not proposed in recommended Wilderness.

Scenery

Introduction

This section examines the effects of the proposed activities on the scenic integrity of the area. Additional information regarding the scenery analysis can be found in the *Rat Creek Salvage Project Scenery Resource Report (*Boisseau 2008) located in the project file.

Alternative 1 – No Action

The forest will continue to offer all scenery integrity objectives (SIO) allocations as outlined in the Forest Plan and described for the project area in Table 28.

Table 28. Forest Plan Scenery Allocations for the project area, SIO descriptions

Scenic Integrity Objective (SIO)	Description	Notes
Moderate	Activity is visible but does not dominate the landscape.	Describes the expected scenery condition for the majority of the Tie-Johnson Management Area.
High	Activity on the landscape is not readily evident.	Describes the expected scenery condition for the outer fringes of the Tie-Johnson Management Area.
Very High	The landscape has a natural appearing condition	Describes the expected scenery conditions for Wilderness and Proposed Wilderness areas.

Direct and Indirect Effects

The overall project area would continue to appear in a burned over state for many years to come. The expected scenery condition for the area where activity (units and temporary roads) is planned is the Moderate SIO as displayed in Table 28. Moderate SIO is met in some areas where only small scale fire and development effects are seen, and the integrity of the landscape is largely intact. However, most of the project area and its surrounds do not appear as such; it appears fragmented, and can be described as meeting low scenic integrity.

Time estimates for when the project area could return to its prescribed SIO of Moderate may vary; but according to research done by scientists from Oregon State University, high levels of tree seedling regeneration is expected within 9-19 years after a fire event. Seedlings will then need time to grow and achieve size and density that brings the landscape from a fragmented, low SIO appearing landscape to one that’s moderate again. Another 10-20 years would seem to be sufficient.

Cumulative Effects

The extent of the cumulative effects analysis is the perimeter of the Rat Creek fire boundary and the scenes in its backdrop, primarily the roadless and wilderness study areas. The no action alternative does not worsen or improve the current visual condition, for now or in the foreseeable future so no cumulative effects are expected. In the long term (20-40 years), as natural conifer regeneration occurs, the burned project area will more closely resemble the unscathed views scene in the background settings.

Alternative 2 – Proposed Action

Direct and Indirect Effects

The proposed actions would take place in the summer road-based recreation allocation setting where timber harvest activity is both suitable and allowed. No activity would occur where harvest activity is not suitable such as Inventoried Roadless and Summer Non-motorized Areas.

A portion of land in the project area (Beaverhead 1-003B) was studied for consideration as an inventoried roadless area, but the designation was never made and the area is considered suitable for harvest activity. However, no activity is proposed here, and its existing characteristic is not expected to be effected by the proposed action.

Of the 35 Units proposed, all but 1 (partial), 2a, 2b, 3, 4, 8, 6, and 11 are planned in Moderate SIO settings, and the proposed activity would meet the SIO of these areas. The SIO of the units just listed occur in High SIO areas. However, due to the dead and dying forest condition that exists, a low or Moderate SIO is the current visual effect. The proposed action would actually serve towards increasing SIO to their target of High once reforestation or green up begins to occur within 5 years. Green up and reforestation will slowly turn a fragmented scene (i.e., of low scenic integrity) to one with a more consistent appearance (i.e., higher integrity).

Harvest units and the sites of harvest operations would be clearly evident in the short term (1-5 years). Also, the actual harvest units would retain live or dead but standing trees to some degree and would not appear as entire clearing. However, as stated above, once green up begins to occur within 5 years, and temporary roads are obliterated, the SIO of the project area overall would remain the same or improve to a higher level as reforestation softens activity and raises the level of scenic integrity over time.

In the long term, the proposed action is expected to render more and better quality forest lands to recreational users who view the scenery as burned over acres are replaced over time with healthier “greener” stands.

Design Features and Mitigation Measures

Project design features ensure that roads are closed using natural features and random patterns, and that slash piles are either removed or scattered at the conclusion of operations. Decreasing linear effects in a random, natural scene increases the scenic integrity of that scene.

Cumulative Effects

Cumulative effects are the result of collective past, present, and reasonably foreseeable future actions. These effects include contrasts in vegetation and line features created by the timber harvest itself, and the roads, slash, and second growth that result. These effects are dynamic and, in general, would diminish over time.

Visual impacts due to past harvests are noticeable throughout the Tie-Johnson management area. Activity has occurred in practically every available area where such activity is acceptable. None of the proposed units will add to this effect.

The cumulative effects of past and proposed activity may change existing visual condition ratings, but not in a manner to exceed Scenic Integrity Objectives of the area where the proposed units are planned. That is, areas that are of Moderate SIO will remain moderate, and areas that are of High SIO will remain high.

Compliance with the Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

The proposed action complies with Forest Plan goals, objectives and standards for scenic resources proposed activities would restore scenic integrity.

Heritage

Introduction

Heritage and/or cultural resources are the physical remains of past human activities having scientific, prehistoric or social values. They include archaeological sites, historic sites, traditional cultural properties (TCPs) and human modified landscapes. TCPs are places significant for their association with cultural practices or beliefs of a living community that are rooted in that community's history and are important in maintaining the continuing cultural identity of the community. Consultation with representatives of the various tribes continues in efforts to identify, protect and preserve this important heritage property type.

An intensive pedestrian cultural resources inventory (Class III) was conducted on each of the 35 proposed treatment units and associated proposed temporary roads. Additional information regarding heritage resources, the methodology used in analysis, or project conditions can be found in the *Rat Creek Salvage Heritage Resource Report* (Sant 2008) located in the project file.

Alternative 1 – No Action

Direct and Indirect Effects

There would be no direct or indirect effects to cultural or heritage resources due to implementation of the no action alternative.

Cumulative Effects

There would be no cumulative effects due to the implementation of the no action alternative because there would be no direct or indirect effects.

Alternative 2 – Proposed Action

Design Features and Mitigation Measures

The proposed action includes a design feature to protect any previously undiscovered cultural resources identified during project implementation. This feature is listed on EA page 13.

Direct and Indirect Effects

No significant heritage or cultural resource values (i.e., sites eligible for listing on the National Register of Historic Places) were identified during the course of the intensive pedestrian

inventory of the proposed treatment units, associated access roads, or identified during the course of project consultation meetings with representatives of Tribal groups. Implementation of the proposed action would not result in direct impacts to heritage or cultural resource values.

Cumulative Effects

There would be no direct or indirect impacts to heritage or cultural resource values so there would be no cumulative effects to heritage resource values within or adjacent to the project area.

Compliance with the Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

- No National Register of Historic Places eligible sites would be impacted through the implementation of the proposed action. A compliance report for the project has been submitted to the Montana State Historic Preservation Office and concurrence regarding "no effects on significant cultural resource values" was received by the Forest on December 1, 2008.
- Heritage and cultural resource values relating to Traditional Cultural Properties (TCP's) have not been identified within the project area after consultation with the Confederated Salish and Kootenai Tribes of the Flathead Reservation and the Shoshone-Bannock Tribes of the Fort Hall Reservation.
- Project design features include measures for unplanned discoveries of heritage resources during project implementation (EA page 13). The timber sale contract will include standard provision B6.24 (BT6.24) to protect cultural resources.

Financial

Introduction

Beaverhead-Deerlodge Forest management activities, specifically timber sales, generate revenues that are returned to the treasury. A financial efficiency analysis is required for timber sales of over $100,000 in advertised value (FSM 2432.12).

Financial efficiency provides information relevant to the future financial position of the program if the project is implemented. Financial efficiency considers anticipated costs and revenues that are part of the Forest Service monetary transactions. Present net value (PNV) is used as an indicator of financial efficiency and presents one tool to be used in conjunction with many other factors in the decision-making process. PNV combines benefits and costs that occur at different times and discounts them into an amount that is equivalent to all economic activity in a single year. A positive PNV indicates that the alternative is financially efficient.

This analysis is not intended to be a comprehensive benefit-cost analysis that incorporates a monetary expression of all known market and non-market benefits and costs, which is generally used when economic efficiency is the sole or primary criterion upon which a decision is made. Many of the values associated with natural resource management are best handled apart from, but in conjunction with, a more limited benefit-cost framework. Their values are discussed in the project environmental assessment, for each resource area.

All costs, benefits, activity timing, and amounts were developed by the project interdisciplinary team or are average values experienced on the Beaverhead-Deerlodge National Forest. The present net value was calculated using Quicksilver (USDA Forest Service 2000), a program for economic analysis of long-term on-the-ground resource management projects. Planning costs

(NEPA) were not included in the analysis of the Proposed Action alternative since they are sunk costs at this point of alternative development.

Financial Efficiency

Financial present net value (PNV) examines revenue and cost implications from the perspective of the Forest Service. It could also be said that this is the perspective of the taxpayer. Only revenues and costs that are recorded in financial records are included in this analysis.

When considering quantitative issues, financial PNV analysis offers a consistent measure in dollars for comparison of alternatives. This type of analysis does not account for non-market benefits, opportunity costs, individual values, or other values, benefits and costs that are not easily quantifiable. This is not to imply that such values are no significant or important, but to recognize that non-market values are difficult to represent with appropriate dollar figures. The values that are not included in this part of the analysis are often at the center of disagreements and interest people show in forest resource projects. Therefore, financial PNV should not be viewed as a complete answer, but one tool decision makers use to gain information about resources, alternatives, and trade-offs between costs and benefits.

PNV is defined as the value of discounted benefits (or revenues) minus discounted costs. A PNV analysis includes all outputs to which monetary values are assigned. In deriving PNV figures, costs are subtracted from benefits to yield a net value. “Future values” (i.e., benefits received in the future) are discounted using an appropriate discount rate to obtain a “present value.” The PNV of a given alternative is the discounted sum of all benefits minus the sum of all costs associated with the alternative. PNV estimates attempt to condense a large amount of information into a single value.

Table 29 summarizes the financial efficiency, including the base rates, predicted high bid (or estimated stumpage value), total revenue and PNV for the Proposed Action alternative. All dollars are in constant dollars with no allowance for inflation. A 4 percent discount rate was used over a period of 10 years (2008-2017), the estimated time required for full implementation of the project. Table 29 indicates the Proposed Action is financially efficient for the timber. The No Action Alternative has no costs or revenues associated with it. The PNV for the Proposed Action is $613,848.

Table 29. Proposed Action Feasibility and Financial Efficiency Summary (2008 dollars)

Proposed Action		
Activity Category	**Measure**	**Value**
Timber Harvest	Area Harvested	1,652 acres
	Volume Harvested (CCF)	24,700 CCF
	Predicted High Bid[8]	$62.50/CCF
	Total Revenue	$1,399,836
All Timber Sale Activities	Present Net Value Costs	($785,988)
	Present Net Value Benefits	$1,399,836
	Present Net Value	$613,848

[8] McNamara 2008

Cumulative Effects

Management of the Beaverhead-Deerlodge National Forest has an impact on the economies of local counties. However, there are many additional factors that influence and affect the local economies, including changes to industry technology, management of other government or private lands, economic growth and international trade. The jobs and labor income associated with timber harvest and reforestation activities in the Proposed Action would contribute to the stability of the local economy during the life of the project.

Less than 7 percent of the stumpage in the seven county area that includes the Beaverhead-Deerlodge National Forest comes from this forest (USDA Forest Service 2009b). The majority comes from private lands. From 1987 to 2005 an average of 14 million board feet of timber were sold from the National Forest. The Proposed Action harvest volume represents approximately 51 percent of average, annual timber sale volume from the Beaverhead-Deerlodge National Forest.

Compliance with the Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

The proposed action would contribute to Forest Plan goals for "Economy Contribution" by providing timber for commercial harvest (USDA Forest Service 2009a, p. 21).

Consultation and Coordination

The Forest Service consulted the following individuals, Federal, State, and local agencies, tribes and non-Forest Service persons during the development of this environmental assessment.

ID Team Members

Matt Boisseau	Forest Service TEAMS Enterprise, Landscape Architect
Jim Brammer	Beaverhead-Deerlodge N.F., Fisheries Biologist
Pam Fletcher	Beaverhead-Deerlodge N.F., Soil Scientist
Carly Gibson	Beaverhead-Deerlodge N.F., Botanist
Steve Kozlowski	Forest Service TEAMS Enterprise, Wildlife Biologist
Glen Lewis	Forest Service TEAMS Enterprise, Fire and Fuels Specialist
Jim McNamara	Beaverhead-Deerlodge N.F., Timber Management Assistant
John Natvig	Forest Service TEAMS Enterprise, Interdisciplinary Team Leader
Steve Overton	Forest Service TEAMS Enterprise, Silviculturist
Dave Salo	Beaverhead-Deerlodge N.F., Hydrologist
Mark Sant	Beaverhead-Deerlodge N.F., Archaeologist
Janice Schultz	Forest Service TEAMS Enterprise, Writer-Editor

Federal, State, and Local Agencies

Jim Olson	Montana Fish, Wildlife & Parks, Big Hole River Fisheries Biologist

Tribes

Confederated Salish and Kootenai Tribes of the Flathead Reservation

Shoshone-Bannock Tribes of the Fort Hall Reservation

Other Contributors and Technical Support

David Fletcher	Beaverhead-Deerlodge N.F., Timber Management Officer
Steve Kujala	Beaverhead-Deerlodge N.F., GIS Specialist
Russell Riebe	Beaverhead-Deerlodge N.F., Wisdom District Ranger
Bruce Schuelke	Beaverhead-Deerlodge N.F., Forest Silviculturist

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Appendix A: Unit Silvicultural and Slash Treatments

Table 30: Salvage harvest unit area, slash treatment and burning

Unit	Acres	Prescription	Slash Treatment	Prescribed Burn
1	111	Salvage harvest and sanitation	Whole-tree yard; pile slash in excess of 20 tons per acre	Burn piles and landing slash
2a	131	Salvage harvest and sanitation	Whole-tree yard; pile slash in excess of 20 tons per acre	Burn piles and landing slash
2b	171	Salvage harvest and sanitation	Whole-tree yard; pile slash in excess of 20 tons per acre	Burn piles and landing slash
3	70	Salvage harvest and sanitation	Whole-tree yard; pile slash in excess of 20 tons per acre	Burn piles and landing slash
4	26	Salvage harvest and sanitation	Whole-tree yard; pile slash in excess of 20 tons per acre	Burn piles and landing slash
4a	7	Salvage harvest and sanitation	Whole-tree yard; pile slash in excess of 20 tons per acre	Burn piles and landing slash
7	44	Salvage harvest and sanitation	Whole-tree yard; pile slash in excess of 20 tons per acre	Burn piles and landing slash
9	4	Salvage harvest and sanitation	Whole-tree yard; pile slash in excess of 20 tons per acre	Burn piles and landing slash
10	60	Salvage harvest and sanitation	Whole-tree yard; pile slash in excess of 20 tons per acre	Burn piles and landing slash
11a	14	Salvage harvest and sanitation	Whole-tree yard; pile slash in excess of 20 tons per acre	Burn piles and landing slash
11b	28	Salvage harvest and sanitation	Whole-tree yard; pile slash in excess of 20 tons per acre	Burn piles and landing slash
11c	8	Salvage harvest and sanitation	Whole-tree yard; pile slash in excess of 20 tons per acre	Burn piles and landing slash
18a	35	Salvage harvest and sanitation	Whole-tree yard; pile slash in excess of 20 tons per acre	Burn piles and landing slash
18b	3	Salvage harvest and sanitation	Whole-tree yard; pile slash in excess of 20 tons per acre	Burn piles and landing slash
18c	18	Salvage harvest and sanitation	Whole-tree yard; pile slash in excess of 20 tons per acre	Burn piles and landing slash
18d	20	Salvage harvest and sanitation	Whole-tree yard; pile slash in excess of 20 tons per acre	Burn piles and landing slash
19a	10	Salvage harvest and sanitation	Whole-tree yard; pile slash in excess of 20 tons per acre	Burn piles and landing slash
19b	5	Salvage harvest and sanitation	Whole-tree yard; pile slash in excess of 20 tons per acre	Burn piles and landing slash
22	13	Salvage harvest and sanitation	Whole-tree yard; pile slash in excess of 20 tons per acre	Burn piles and landing slash
22a	82	Salvage harvest and sanitation	Whole-tree yard; pile slash in excess of 20 tons per acre	Burn piles and landing slash
23	158	Salvage harvest and sanitation	Whole-tree yard; pile slash in excess of 20 tons per acre	Burn piles and landing slash
23a	6	Salvage harvest and sanitation	Whole-tree yard; pile slash in excess of 20 tons per acre	Burn piles and landing slash

Unit	Acres	Prescription	Slash Treatment	Prescribed Burn
24	13	Salvage harvest and sanitation	Whole-tree yard; pile slash in excess of 20 tons per acre	Burn piles and landing slash
25	82	Salvage harvest and sanitation	Whole-tree yard; pile slash in excess of 20 tons per acre	Burn piles and landing slash
25a	3	Salvage harvest and sanitation	Whole-tree yard; pile slash in excess of 20 tons per acre	Burn piles and landing slash
26a	16	Salvage harvest and sanitation	Whole-tree yard; pile slash in excess of 20 tons per acre	Burn piles and landing slash
26b	4	Salvage harvest and sanitation	Whole-tree yard; pile slash in excess of 20 tons per acre	Burn piles and landing slash
27	37	Salvage harvest and sanitation	Whole-tree yard; pile slash in excess of 20 tons per acre	Burn piles and landing slash
27a	8	Salvage harvest and sanitation	Whole-tree yard; pile slash in excess of 20 tons per acre	Burn piles and landing slash
30a	125	Salvage harvest and sanitation	Whole-tree yard; pile slash in excess of 20 tons per acre	Burn piles and landing slash
30b	19	Salvage harvest and sanitation	Whole-tree yard; pile slash in excess of 20 tons per acre	Burn piles and landing slash
30c	4	Salvage harvest and sanitation	Whole-tree yard; pile slash in excess of 20 tons per acre	Burn piles and landing slash
31	295	Salvage harvest and sanitation	Whole-tree yard; pile slash in excess of 20 tons per acre	Burn piles and landing slash
31a	12	Salvage harvest and sanitation	Whole-tree yard; pile slash in excess of 20 tons per acre	Burn piles and landing slash
sp1	7	Salvage harvest and sanitation	Whole-tree yard; pile slash in excess of 20 tons per acre	Burn piles and landing slash

Appendix B: Past, Present and Reasonably Foreseeable Management Activities within the Rat Creek Fire Perimeter

Table 31 summarizes silvicultural and fuel activities that have occurred within the Rat Creek Fire perimeter. These activities were recorded in the Forest activities data base (FACTS). Additional activities within the Rat Creek Fire perimeter include:

- Tie-Johnson grazing allotment (vacant since the Rat Creek Wildfire)
- Rat Creek Roadside Salvage (2008, ongoing)
- Travel management and road maintenance
- Dispersed recreation
- Recent wildfires within or adjacent to the Rat Creek Wildfire include: Elk Creek, 1998, 200 acres; Mussigbroad, 2000, 44,352 acres (north and west of Rat Creek Wildfire); Sheep Creek, 2002, 2016 acres (south); Shultz Saddle, 2006, 60 acres.
- Burned area emergency rehabilitation measures following the Rat Creek Wildfire included: fire line rehabilitation; erosion control structures on 18.5 miles of trail; road surface drainage control (30 waterbars, 30 rubber diversion structures, outlet erosion control; South Fork Tie Creek arched culvert replacement with a bridge; road culvert replacements (6 each); ditch cleaning; native seeding (10 acres); roadside hazard tree felling.

Table 31: Past Activities (acres) within the Rat Creek Fire Perimeter (source: Forest activities database, FACTS)

Year	Patch Clearcut	Stand Clearcut	Clearcut with Reserves	Individual Tree Selection	Sanitation & Salvage	Special Cut[9]	Slash	Precommercial Thin	Broadcast Burn	Jackpot Burn	Year total
	4111	4113	4114	4151	4230	4240	4465	4521	4978	4979	Grand Total
1964		14									14
1967		10									10
1970		94									94
1974		132									132
1976									119	246	365
1978								53			53
1979							125				125
1981		4	2								6

[9] Special cut was a salvage harvest of roadside hazard trees following the Sheep Creek Wildfire of 2002

Year	Patch Clearcut	Stand Clearcut	Clearcut with Reserves	Individual Tree Selection	Sanitation & Salvage	Special Cut[9]	Slash	Precommercial Thin	Broadcast Burn	Jackpot Burn	Year total
	4111	4113	4114	4151	4230	4240	4465	4521	4978	4979	Grand Total
1982			3								3
1983								390			390
1985										3	3
1986				3			207				210
1987		60	20	12			194				286
1988									41		41
1989			23	83	196		651				953
1990	39	3			329						371
1991		25			454		180	138			797
1992								32		4	36
1994	12				599		23				634
1995					539						539
1996					18						18
2002						192					192
2003						313					313
Grand Total	**51**	**342**	**48**	**98**	**2135**	**505**	**1380**	**613**	**160**	**253**	**5585**